The Relationship between Market Forces and Gender Differences in Physician Pay

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Abstract

Using geographical variation in HMO enrollment growth, I examine the relationship between market competition and the gender gap among physicians. A one standard deviation increase in HMO market share improves the relative earnings of female physicians by 1.5 percent, reducing the pay gap by 40 percent between 1980 and 1999. Moreover, between 2000 and 2007 when HMO enrollments declined, the gap widened significantly—reversing about half of the previous gains. No such relationship is found for other groups such as college graduates, individuals with professional degrees, or lawyers. Data from the Young Physicians Survey shows that increased market competition compresses the distribution of physician earnings and reduces economic rents disproportionately captured by men, accounting for one third of the improvement in the gender gap. The remaining two-thirds is attributed to factors that increased the relative demand for specialty fields and practice settings that typically employ a greater share of women.

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1. Introduction

The lack of recent progress in closing the gender gap in pay within professional occupations in the U.S., including medicine, has raised a number of questions—particularly as differences in labor market characteristics between men and women have continued to narrow. Recent studies have documented large, and in some cases widening, disparities regarding how female physicians are paid relative to their male colleagues in the U.S. that cannot be explained by remaining differences in observable characteristics (LoSasso et al 2011, Jena et al. 2016). Moreover, although the trend in the relative hourly earnings of female college graduates has been well-documented (Mincer and Polachek 1974; Gunderson 1989; Goldin 1990; Blau 1998), the timing and magnitude of the change in the gender gap among physicians has been quite different.

This study contributes to the literature by examining the disparity in pay among physicians over the past several decades, finding that much of the movement in the gender gap in medicine during this period has been in response to product market competition—most notably the rise and subsequent decline in managed care organizations such as Health Maintenance Organizations (HMOs). Panel A of Figure 1 shows that the gender gap among physicians narrowed as HMO market share increased during the 1980s and 1990s and then widened after 2000 when HMOs enrollments declined. Taken as a whole, the two series appear to move together over this time period. In contrast, changes in the gender gap for college graduates, individuals with professional degrees, or even other male-dominated occupations such as law do not show any correlation with changes in HMO enrollments.

This correlation between the gender earnings gap among physicians and HMO market penetration over time can potentially provide some indication as to the source of the remaining pay disparity in medicine and perhaps other professions. For example, previous studies of other professional occupations have found that regulatory changes or market forces have the potential

to reduce economic rents that arise from imperfect competition and informational asymmetries. In occupations where these rents were disproportionately captured by men, the reduction in rents has been shown to narrow the gender earnings gap (Black and Strahan 2001, Black and Brainerd 2004). However, it may also be the case that the adoption of managed care practices affected the market for physician services in other ways that might have benefited female physicians, such as increasing the demand for specialties and/or practice settings that are favored by women or narrowing gender differences in productivity.

This paper examines the relationship between changes in the market for physician services, as proxied by HMO market share, and changes in physician pay. Specifically, I demonstrate how market forces can affect the gender gap within a professional occupation, such as medicine, and also explore the underlying mechanisms driving these changes. Using a differences-in-differences (DD) methodology, I find that a one standard deviation increase in HMO enrollment growth reduces the gender earnings gap by 1.5 percent, improving the gender gap in hourly earnings by roughly 40 percent between 1980 and 1999. Moreover, between 2000 and 2007 when HMO enrollments were declining, the gender gap among physicians widened significantly by almost 25 percent—reversing about half of the previous gains. In contrast, no such relationship exists between changes in HMO enrollments and changes in the gender gap among other groups such as college graduates, individuals with professional degrees, or lawyers.

Further, I use data from the Young Physicians Survey during the late 1980s and early 1990s to explore the potential mechanisms underlying the relationship between changes in the market for physician services and the gender gap. Using the same empirical approach, I find that the spread of HMOs appears to affect the relative earnings of male and female physicians by compressing the overall distribution of physician earnings and reducing economic rents that had previously been disproportionately captured by male physicians. Decomposing the gender gap

shows that this change in the wage structure can account for about one third of the improvement in the gender earnings gap among physicians in the high-growth managed care states. The remaining two-thirds of the improvement is attributed to factors that increased the relative demand for specialty fields and practice settings that typically employ a greater share of women.

The rest of the paper is organized as follows. Related literature on the gender earnings gap among physicians as well as the effect of market forces on the gender gap are presented in Section 2. Section 3 presents the institutional background related to changes in market competition arising from the advent and spread of managed care organizations, including HMOs. A description of the data and empirical strategy can be found in Section 4 followed by the main results in Section 5. I then perform several robustness checks in Section 6 and explore the mechanisms underlying these changes in Section 7. Section 8 summarizes and concludes.

2. Related literature

2.1 The gender earnings gap among physicians

Previous studies have documented the gender earnings gap among U.S. physicians using a variety of datasets at different points in time. Kehrer (1976) found that female physicians earned only 70 percent of the hourly wages of male physicians in the early 1970s, although that ratio rose to 78 percent once adjusted for differences in observable characteristics of female versus male physicians. Langwell (1982) showed that the overall ratio of female to male hourly earnings had risen to 78 percent as of 1978, yet the adjusted hourly earnings ratio had improved only slightly to 81 percent. Using an improved specification, Ohsfeldt and Culler (1986) found that the adjusted hourly earnings ratio for females was in fact higher and estimated that females were paid 87 percent of male earnings as of 1982 on an adjusted basis.

The ratio of female to male earnings increased rapidly during the 1980s—despite considerable remaining gender differences among physicians in labor market characteristics such

as hours worked, patient mix, specialty field, and practice setting. By some estimates, the adjusted gender gap among U.S. physicians completely disappeared during the 1990s for some groups. For example, Baker (1996) found that as of 1992 there was no significant difference in hourly pay among a sample of young physicians after adjusting for specialty field and practice setting, yet sizeable differences in annual earnings remained with women earning only 83 percent of male incomes. The greater disparity in annual pay was shown to reflect the differences in hours worked between men and women related to family responsibilities (Sasser 2005).

More recently, it appears that the gender wage gap among physicians may have widened since 2000. Between 1999 and 2008, the starting salaries of male versus female physicians leaving residency programs in New York State diverged over time resulting in a significant gender gap that cannot be explained by specialty choice, practice setting, hours of direct patient care, or other characteristics (LoSasso et al 2011). In spite of the accelerating entry of female physicians into formerly male-dominated and traditionally higher paying subspecialties, the gap in physician compensation during this period widened from an insignificant gap of 2.1 percent ($3,600) in 1999 to a statistically significant gap of 8.0 percent ($16,819) in 2008.

Other studies have documented that large differences in physician pay by gender currently exist in the U.S.—even among the most skilled physicians and when controlling for a wide variety of factors. Among academic physicians at American public medical schools, female faculty earned just 80 percent of the annual salaries of male faculty (Jena et al 2016). Controlling for a wide range of physician characteristics including age, years of experience, faculty rank, specialty, scientific authorship, National Institutes of Health funding, clinical trial participation, and Medicare reimbursements, the adjusted earnings ratio rose to 92 percent but did not reach parity. In addition, gender differences in salary varied widely across specialties, institutions, and faculty ranks such that the adjusted salaries of female full professors were comparable to those of

lower-ranked male associate professors. Similar findings have also been reported in earlier studies of U.S. medical academics suggesting that there has been little improvement in the gender gap among this group—if any—over the past decade (Ash et al 2004).

2.2 The relationship between market forces and the gender gap

Several earlier studies have explored the relationship between market changes and the gender wage gap. Black and Strahan (2001) examine changes in bank regulations from the 1970s through 2000 and find that although average compensation and wages for banking employees fell after deregulation, the decrease was greater for men (12 percent) than for women (3 percent). Women's share of employment in managerial positions also increased after deregulation. The authors interpret this finding to suggest that prior state-level restrictions on banks' ability to expand across state lines had previously inhibited competition and allowed the industry to enjoy economic rents and these rents were mainly shared with men. As deregulation occurred and competition increased, the ability of employers to share these economic rents according to their preferences declined—in essence it became more costly to discriminate (Becker 1957). Similarly, Ashenfelter and Hannon (1986), using firm-level data on a cross-section of banking markets in Pennsylvania and New Jersey, find a negative and statistically significant relationship between market concentration and the share of female employment at each bank.

Other studies have focused on the dynamic implications of Becker's theory of discrimination—that changes in the competitive environment will lead to changes in discriminatory practices. For example, Black and Brainerd (1999) found that increased product market competition from international trade increased the relative wage of women in previously concentrated versus competitive manufacturing industries. Hirsch et al. (2014), using linked employer-employee panel data for West Germany, find that intensified competition significantly lowers the unexplained portion of the gender gap in plants with neither collective agreements nor

a works council. Conversely, there is no effect in plants that have these types of wage-setting institutions, consistent with Becker's model of taste-based employer wage discrimination being limited by competitive forces.

3. Institutional background

3.1 Increasing market competition: The advent and spread of managed care

Today in the United States, the term "managed care" is generally used to describe a set of practices intended to reduce the cost of providing health benefits and improve the quality of care. These techniques include a variety of economic incentives for physicians and patients to select less costly forms of care such as programs for reviewing the medical necessity of specific services, increased beneficiary cost sharing, controls on inpatient admissions and lengths of stay, selective contracting with health care providers, and the intensive management of high-cost health care cases. Often these techniques are overseen by managed care organizations or delivery systems that combine the financing and delivering healthcare to their enrollees.

Prior to the advent of managed care in the 1980s, the health care industry operated under an indemnity-based insurance system where providers were compensated on a fee-for-service basis such that either all or a large percentage of the provider's fee was reimbursed by the insurer. Under this fee-for-service system, physician payments were based on a schedule of "usual, customary, and reasonable" (UCR) limitations determined by profiles of physician services and charges that varied by geographic area. Yet the fee limitations imposed by insurers were weak and affected only those fees at or near the very top of the distribution, with many insurers using a 90th percentile cutoff for determining payments to physicians. Moreover, under traditional indemnity insurance the financing function of the payer or insurer was separate from the service delivery function of the provider, an arrangement resulting in few payer-imposed limitations on services provided to patients. Because insurers and patients had less information

about health needs and medical technology than providers, insurers could not guarantee that only cost-effective care would be provided. As a result, patients and physicians could make treatment decisions that might only marginally improve health outcomes while largely ignoring the marginal costs associated with such care.[1]

With the passage of the Health Maintenance Organization Act in 1973, the federal government provided grants and loans to provide, start, or expand an HMO and removed certain state restrictions for federally qualified HMOs (Gruber et al 1986).[2] Private sector market entry was encouraged by the 1976 Amendments to the HMO Act, which mandated employers of 25 workers or more to offer a locally available, federally qualified plan if they offered health insurance (Morrison and Luft 1990). As a result, HMO plans grew rapidly during the 1980s and 1990s, with the number of people enrolled in HMOs rising from just 3 million in 1970 to a peak of 104 million in 1999 (InterStudy, various years).

These newly formed HMOs typically contracted with a select network of physicians and hospitals and were able to control costs by negotiating discounts with providers at the 60th or 70th, rather than the 90th, percentile. Hospitals and physicians agreed to limit their fees in exchange for inclusion in the network. In return, managed care organizations encouraged their insured patients to select participating providers by using financial incentives such as lower deductibles and/or coinsurance rates, thereby increasing patient volume for physicians and hospitals within the network. Some HMOs also negotiated at-risk compensation arrangements with providers rather than discounts from existing UCR limits, thus transferring some of the risk of the cost of care to physicians. HMOs also discouraged excessive utilization of medical

[1] It has also been suggested that physicians could "induce demand" among their patients by recommending overly complex or expensive treatments (Fuchs 1978).
[2] See the online appendix for more details about the spread of HMOs in the healthcare market.

services and procedures by monitoring providers carefully, penalizing them if they were profligate, and offering them financial incentives to provide only necessary care. These measures were intended to minimize the variation in practice styles that can lead to excessive costs.

3.2 The impact of HMOs on U.S. health expenditures and physician incomes

The rapid growth of HMOs were credited with subduing medical cost inflation in the late 1980s by reducing unnecessary hospitalizations, forcing providers to discount their rates, and causing the healthcare industry to become more efficient and competitive (Gaynor, Rebitzer, and Taylor 2004, Gaskin and Hadley 1997, Baker 1997, Wickizer and Feldstein 1995, Debrock and Arnould 1992). Managed care plans and strategies proliferated and quickly became nearly ubiquitous in the United States. As a result, the growth in U.S. health expenditures, including physician services, slowed dramatically as HMO market penetration increased.[3]

However, this rapid growth led to a consumer backlash as cost-control efforts created the widespread perception that HMOs were more interested in saving money than providing health care.[4] The volume of criticism led many states to pass laws mandating new standards for HMOs, and insurers responded by offering other plan options with more comprehensive care networks and fewer restrictions on services.[5] By the late 1990s, U.S. per capita healthcare spending began to accelerate again as HMO market penetration fell.[6]

Not surprisingly, the advent of managed care impacted the growth in physician incomes as well. Several studies find that HMOs reduced physician fees and incentives to provide services while slowing income growth (Zwanziger 2002). Physicians in contractual arrangements with HMOs and other managed care organizations reported an incentive to decrease services

[3] See the online data appendix for the trend in healthcare expenditures versus HMO enrollments over time.
[4] The backlash against managed care, Nation's Business, July 1998, accessed 2007-10-05
[5] The backlash against managed care, Nation's Business, July 1998, accessed 2007-10-05
[6] The Factors Fueling Rising Healthcare Costs 2006, report prepared by Price Waterhouse Coopers for America's Health Insurance Plans, January 2006, accessed 2007-10-05

compared to fee-for-service contracts (Mitchell and Hadley 1999; Hennig-Schmidt, Selten, and Wiesen, 2011). As a result, survey data collected in 1991 and 1997 from a panel of almost 1,500 physicians showed that the growth of HMOs was related to lower income growth as well as reductions in practice autonomy and satisfaction among physicians (Hadley and Mitchell 2002).

4. Data and empirical strategy

4.1 Physician earnings data

The primary source of data for physician earnings used in this study is the Current Population Survey, a nationally representative survey of individuals that captures information on earnings, hours worked, occupation, education, state of residence, and a variety of demographic characteristics. To identify physicians, the sample is restricted to individuals age 25 to 64 years in the civilian non-institutional population, who hold an advanced degree but are not currently enrolled in school, and list their occupation as physician.[7] To ensure sufficient attachment to the labor market while still allowing part-time or part-year work, individuals who worked less than 20 hours per week or 26 weeks per year were excluded.[8]

The main dependent variable in the analysis is the ratio of female to male real earnings among U.S. physicians.[9] Recognizing the differences in hours worked between men and women, results are also presented for the gender gap in hourly and annual earnings as well as weekly hours worked. Given the high rate of self-employment among physicians, annual earnings are calculated as the sum of wage and salary plus business income. Hourly earnings are calculated as

[7] An advanced degree is any degree beyond a bachelor's degree (for CPS years 1990 or later) or having 18 or more years of education (CPS year prior to 1990). Occupation is identified using the 2010 Standard Occupational Classification code provided by IPUMS (physician=3060).
[8] Such physicians are generally considered inactive under AMA guidelines and have such low levels of labor force attachment that their earnings data are likely to be unreliable.
[9] All earnings values were adjusted for inflation using the implicit price deflator to reflect 2007 dollars.

annual earnings divided by annual hours. I exclude physicians with hourly wages that were below the minimum wage that prevailed during the year when income was measured.

Table 1 reports descriptive statistics from the CPS regarding basic demographic and labor market characteristics as well as earnings of male versus female physicians during the endpoints of each period in which HMO market penetration was either rising: 1980 through 1999 or falling: 1999 through 2007.[10] Data are pooled into non-overlapping five-year intervals centered on the observation year for the endpoints of each period to ensure sufficient sample size for calculating the gender gap at different points in time due to the small number of female physicians surveyed in the CPS, particularly during the earlier years.

As documented in prior studies, Table 1 indicates that although the demographic and labor market characteristics of male and female physicians have become more similar over time, significant differences persist. For example, female physicians are on average younger, less likely to be married or have children, and more likely to live in an urban area compared to men. In addition, female physicians worked on average one week less per year and 4 to 6 hours less per week than their male counterparts and were also 10 to 18 percentage points less likely to be self-employed. However, despite these persistent differences in observable characteristics, the gender earnings gap among physicians narrowed considerably during the 1980s and 1990s. The ratio of female to male hourly earnings increased from 0.664 in the early 1980s to 0.870 at the end of the 1990s, with similar improvements in the annual earnings gap during this period. Even more striking is the reversal of these improvements in the unadjusted gender gap among physicians between 1999 and 2007.

[10] The study period ends in 2007 so as not to confound changes in physician earnings related to the decline in HMO enrollments to those associated with aggregate labor market conditions (e.g., the Great Recession) or more general health care reforms (e.g., the 2010 Affordable Care Act).

The advantage of the Current Population Survey (CPS) is that it covers a long period of time during which one can examine the relationship between changes in the gender earnings gap among physicians. In addition, the CPS includes data on all types of physicians so it is possible to explore the overall gender earnings gap for physicians rather than particular specialties, practices, or demographic groups. Most importantly, the CPS contains information on individuals in other professional occupations, yielding placebo groups that can be used to control for factors that may affect the incomes of all professional women—not just physicians.

One disadvantage of the CPS is that it imposes top-coding on reported earnings, artificially reducing the income near the top of the distribution which is disproportionately composed of men.[11] Previous research has demonstrated that top-coding can affect the measurement of both the magnitude and the trend of the gender gap over time because the share of individuals hitting the top-code threshold as well as the thresholds themselves change over time (Burkhauser and Larrimore 2009, Larrimore et al 2008). In response, the Census Bureau constructed a consistent topcoded earnings series from 1975 through 2010 which I use to construct the earnings measures reported here.[12]

The other disadvantage of the CPS is that it does not contain information on specialty or practice setting—characteristics which have been shown to explain much of the earnings gap between male and female physicians and were also affected by managed care. To address this shortcoming I also make use of the Young Physicians Survey (YPS), a nationally representative survey of physicians (about 4,000 men and 2,000 women) under 40 years of age who have been practicing medicine continuously for two to five years. The YPS was designed to investigate the

[11] Relative to other workers, top-coding affects a high proportion of physicians—upwards of 30 percent of males and 10 percent of females in a given year. See the data appendix for details on the proportion of the sample that is affected by top-coding.
[12] See the online appendix for more details about the methods used by the Census to create this series.

factors influencing the career decisions of young physicians and covers a wide range of topics including specialty, practice setting, hours, income, number of patients, and other professional and demographic characteristics.[13] I make use of both the cross-sectional as well as the longitudinal components of the YPS to examine market changes on new labor market entrants versus incumbent physicians and explore the mechanisms by which these market changes affected the earnings of male versus female physicians. Yet one drawback of the YPS is that it was conducted in 1987 and 1991, yielding only a short time period during which to observe how HMO growth affected the gender gap among physicians.

4.2 HMO market penetration

To explore how market competition arising from the diffusion of managed care affected the gender gap among physicians, I use the geographical variation in HMO market penetration across the United States over time, calculated as total HMO enrollments as a percentage of each state's population.[14] During the 1980s and 1990s, there was considerable geographical variation as national HMO enrollments were growing rapidly, with the growth in HMO market penetration ranging from 10 percentage points or less in states such as Alaska, Idaho, Montana, and, Wyoming, to 40 percentage points or more in states such as Connecticut, Pennsylvania, Tennessee, and Utah (see Figure 2). In contrast, during the 2000s when HMO enrollments were declining nationally, states such as California, Delaware, and Kentucky experienced drops in HMO market shares that were greater than 30 percentage points compared to other states such as Colorado, Nevada, and Hawaii where market share even grew slightly by one to three percentage

[13] I impose the sample restrictions similar to those listed above for the CPS, but also exclude physicians who were no longer practicing or were still in a training program at the time of the survey. See the online appendix for details about the Young Physicians Survey.

[14] These data have been reported consistently over the past 30 years by the health care industry in various formats including the *HMO Industry Report* published by InterStudy from 1991-1999, the *HMO-PPO Digest* published by Aventis from 2000-2009, and finally the *Managed Care Digest Series* published by Sanofi from 2010-2015 https://www.managedcaredigest.com/ .

points. Moreover, the states that experienced large increases in HMO market share during the 1980s and 1990s were not the same as those experiencing large declines during the 2000s—providing additional variation with which to establish a causal relationship.

One caveat to this approach is that aggregate measures of HMO enrollments at the state level mask differences in enrollment across HMO types which differ with respect to the intensity and breadth of their approach to utilization management. For example, IPA or Network HMOs place fewer restrictions on physicians in terms of utilization and treatment guidelines than Group or Staff HMOs where physicians are employees and the HMO intervenes much more aggressively in the decision making of physicians and patients.[15] Unfortunately there are no public data sources that report HMO enrollments by type for states over time, so I use total HMO enrollments as the primary indicator of market penetration.

In addition, HMO enrollments do not capture changes in the growth of other types of managed care organizations, such as Preferred Provider Organizations PPOs, which are less restrictive in terms of both physician reimbursement and gatekeeping of specialty services.[16] However, because few PPOs enroll their own members, there is no reporting on aggregate enrollments. As such, I will rely on HMO enrollments as a proxy for the growth in other managed care plans. Note that this approach assumes that states where HMO market penetration increased rapidly were also places where PPO market penetration grew rapidly.

4.3 Empirical strategy

The basic approach is to examine whether the gender earnings gap for physicians narrowed more in states with high HMO growth relative to states with low HMO growth by

[15] However, both types of HMOs restrict payments to providers either through capitation (IPA/Network HMOs) or salary (Group/Staff HMOs).

[16] PPOs attempt to influence patients' choice of providers through offering differential cost-sharing that rewards the patient who selects a provider from the PPO network. See the online appendix for more details.

using a differences-in-differences (DD) strategy:

$$\Delta(\ln W_{FH} - \ln W_{MH}) - \Delta(\ln W_{FL} - \ln W_{ML}).$$

In the expression above, *ln W* represents log earnings, the *F* and *M* subscripts refer to females and males, and the *H* and *L* subscripts refer to high-growth and low-growth managed care states. Using this framework, states can be categorized as "high" versus "low" based on their growth in HMO penetration relative to the nation as a whole. For example, to examine the decade of rapid HMO enrollment growth during the 1980s and 1990s, states with high managed care growth (termed "high growth") are defined as those states where HMO market share grew faster than the national average (33 percentage points) between 1980 and 1999.[17] An analogous approach was used to examine the decline in HMO market share during the 2000s.[18]

This initial approach compares changes in earnings over time for male versus female physicians that were exposed to different market conditions while potentially reducing the measurement error associated with using the growth in HMO market share as a proxy for the spread of managed care. Using this dummy variable approach will capture changes in the broader diffusion of managed care more if the classification of high versus low growth states is generally correct, yielding a simple and easily interpreted methodology given the crude continuous measure of managed care growth that is available. In contrast, the continuous variable measure coefficient may need to be rescaled if HMO growth understates the overall rate of managed care growth. For robustness, I present both sets of estimates.

To account for relative improvements in the earnings of female physicians that can be

[17] Between 1980 and 1999 states with above average increases in market penetration included Arizona, California, Colorado, Connecticut, Delaware, Illinois, Iowa, Maryland, Massachusetts, Michigan, New Jersey, New Mexico, New York, Ohio, Oregon, Pennsylvania, Rhode Island, Utah, and Wisconsin.

[18] Between 1999 and 2007 the average decrease in HMO market share was 12 percentage points. States with above average decreases included California, Colorado, Delaware, Florida, Kentucky, Louisiana, Massachusetts, Missouri, Minnesota, New Hampshire, New Jersey, Oregon, Pennsylvania, Rhode Island, Tennessee, and Utah.

attributed to changes in observable characteristics, I use the following OLS framework:

$$ln\ W_{ijt} = \beta_0 + \beta_1 X_{ijt} + \beta_2 \tau_t + \beta_3 \delta_j + \beta_4 FEMALE_i + \beta_5 (\tau_t \bullet \delta_j) + \beta_6 (\tau_t \bullet FEMALE_i)$$

$$+ \beta_7 (\delta_j \bullet FEMALE_i) + \beta_8 (\tau_t \bullet HIGHMC_j \bullet FEMALE_i) + \varepsilon_{ijt}, \quad (1)$$

where *i* indexes individuals, *j* indexes states, and *t* indexes years. The dependent variable, $ln\ W_{ijt}$ is log real earnings (or log hours) and *X* is a vector of demographic characteristics. Using the period of rapid HMO growth as our example, the variable τ_t is equal to 0 for 1980 and is equal to 1 for1999. The variable δ_j represents a full set of state dummy variables to control for the time-invariant characteristics of the states. *FEMALE* is a dummy variable to control for the time-invariant characteristics of female physicians. *HIGHMC* is a dummy variable that equals 1 for high growth HMO states (and 0 otherwise). The second-level interactions control for changes over time in each state, changes over time for female physicians, and the time-invariant characteristics of female physicians in each state. The triple interaction term captures the variation in wages specific to female physicians (relative to males), in high growth HMO states (relative to low), in 1999 (relative to 1980). I also use the growth in HMO market share as a continuous variable by replacing the dummy variable in equation (1) with the actual change.[19] Standard errors are clustered by state to minimize the bias due to serial correlation that arises from DD analyses (Bertrand and Mullainathan, 2002).[20]

The identification of the impact of changes in market competition on the gender earnings gap in equation (1) relies on cross-state variation over time in HMO enrollment growth. Nevertheless HMO care penetration and physician incomes may be simultaneously determined.

[19] Note that by including time and state fixed effects, I am controlling for changes in economic and health system conditions at the state level.

[20] Clustering the standard errors by state and year does reduce the magnitude of the standard errors and increase the significance of the results.

If forward-looking HMOs consider current and expected future health care expenditures when deciding whether to enter or expand operations in a market, then HMOs may choose to locate in high expenditure areas only if they can provide highly cost-effective care. Alternatively, the demand for HMOs by purchasers of health care coverage may be higher in high expenditure areas given that HMOs are generally viewed as an effective cost containment measure. This would suggest that HMOs would choose to locate where physician incomes are higher, although it is not clear that HMO growth would be more likely to occur where the gender earnings gap among physicians is higher unless the gap is increasing in the average level of income. Nevertheless, to control for factors affecting HMO diffusion that might be correlated with physician incomes during the 1980s and 1990s, I follow the literature and instrument for HMO market share using the degree of concentration in hospital markets as well as the average number of employees per firm (Baker 1994; Dranove, Simon, and White. 1998; Simon, Dranove, and White 1998; Mitchell and Hadley 1999).[21]

Another threat to the identification strategy is omitted variable bias. For example, it could be the case that the improvement in the relative earnings of female physicians simply reflects other factors associated with states that affected all professional women. Indeed, previous research has demonstrated that changes in unobservable characteristics among women (e.g. stronger career commitment) contributed to narrowing the "unexplained" portion of the gender wage gap among all college-educated U.S. women during the 1980s (Blau and Kahn 1997). If these changes in the unobservable characteristics of professional women were somehow correlated with the spread of managed care to certain states, then estimates of the impact of managed care on the gender earnings gap among physicians from equation (1) would be

[21] Please see the online appendix for more information on the source and construction of these variables and the first stage regression. An F test rejects the hypothesis that the coefficients of both variables are jointly equal to zero.

upwardly biased. As a robustness check, I use three placebo groups (college educated, professionals with advanced degrees, and lawyers) within each state to control for factors that might lead to improvements in the relative earnings of all professional women.

A final threat to identification is selection bias. It could be the case that physicians are able to select more favorable labor market conditions, choosing to practice medicine in states where the return to their skills would be the highest (Escarce et al 1998). High-fee (e.g. male) physicians may choose to locate in low managed care states with higher reimbursement. Alternatively, female physicians might be more constrained in their migration choices due to the need to co-locate with a working spouse in a professional occupation (Compton and Pollack 2007). If male physicians are differentially migrating to low versus high managed care states, then estimates of the impact of managed care on the gender earnings gap among physicians from equation (1) would again be upwardly biased. As a robustness check I make use of the longitudinal component of the YPS to study the impact of changes in HMO market shares on a cohort of incumbent physicians who did not migrate across states.

5. Results

Before turning to the estimates from equation (1), it is instructive to compare the raw difference-in-difference (DD) results for the two periods during which HMO market penetration changed dramatically. During the first period when HMO market shares increased rapidly from 4.0 percent in 1980 to 38.3 percent in 1999, Table 2 shows that the gender earnings gap among physicians improved in the high-growth states relative to the low-growth care states, with almost all of the gains driven by an improvement in hourly earnings. Column (1) shows that both the annual and hourly earnings of female physicians grew twice as fast as that for men in states experiencing above-average growth in HMO market share during this period, resulting in a significant reduction in the gender gap in hourly earnings of 0.219 log points or 24.5 percent. In

contrast, Column (2) reveals roughly the opposite occurring in states with below-average HMO growth, with the hourly earnings of men growing faster than that of women, although the change in relative earnings across men and women was not significant. Taking the triple difference demonstrates that over the entire 20 year period, the gender gap in hourly earnings narrowed by 0.477 log points (61.1 percent) among physicians in states with rapidly increasing HMO market shares relative to those where HMO enrollments grew more slowly.[22]

In addition, we know that the backlash against managed care practices during the early 2000s caused HMO enrollments to decline. During this later period, HMO market penetration fell from a peak of 38.3 percent in 1999 to 26.0 percent in 2007 before stabilizing thereafter. Column (6) of Table 2 demonstrates that in states where HMO market penetration decreased more rapidly than the national average between 2000 and 2007, the gender earnings gap among physicians widened significantly—on the order of 0.222 log points (24.9 percent) for hourly earnings—relative to those with below-average declines in HMO market shares. The shorter duration and correspondingly smaller change in HMO market shares during this later period likely explains why this reversion is smaller in magnitude and significance than the initial narrowing of the gender gap when HMO market shares were rising rapidly. Nevertheless, these estimates provide confirmatory evidence that the gender earnings gap and market competition, as measured by HMO growth, move in tandem.

Using the growth in HMO enrollments as a continuous measure, Table 3 reports the coefficient on the triple interaction term from equation (1) for various specifications that include different sets of controls. The inclusion of demographic characteristics in Column (2) as well as the inclusion of state fixed effects in Column (3) do little to reduce the estimated impact of HMO

[22] See the online appendix for the breakdowns of the growth in earning for men and women in the high versus the low managed care states during this period.

diffusion.[23] Instrumenting for HMO growth in column (4) reduces the coefficient on the gender gap in hourly earnings slightly in magnitude but not significance, confirming that although HMO diffusion may be simultaneously determined with physician incomes to some extent, it is not endogenous to changes in the gender earnings gap among physicians.

The impact of market forces on the gender earnings gap among physicians is economically meaningful. The IV estimates in Table 3 indicate that a one percentage point increase in HMO market penetration is associated with a 1.5 percent increase in the earnings of female physicians relative to males. To compare the results to those in Table 2, the coefficients using the continuous variable measures are evaluated for the average difference in HMO growth between the high-growth and the low-growth states. The results are strong and similar with the average increase in HMO market penetration improving the gender gap in hourly earnings by 0.346 log points (41.3 percent) over the entire 20-year period from 1980 to 1999.

However, it is still possible that changes in the unobservable characteristics of professional women (e.g. career commitment) are somehow correlated with changes in market competition in certain states. To account for this possibility, Table 4 reports the differences-in-differences estimates for physicians as well as college graduates, other professionals with advanced degrees (excluding physicians), and lawyers for the initial period of rapid HMO growth. While rising HMO market shares significantly improved the relative earnings of female physicians, it had no effect on the gender earnings gap for the other three groups. Taking the quadruple difference between physicians and any of the three other groups, I find that the rapid increase in HMO market penetration continues to have a large and positive effect on the gender earnings gap among physicians. These results suggest that increased competition in the market

[23] Experience is calculated as age minus years of education in the Current Population Survey.

for physician services improved the relative earnings of women physicians *aside* from other forces that affected all college and/or professional women.

6. Robustness checks

The estimates presented using the CPS are quite compelling and useful for assessing changes in the gender earnings gap among *all* physicians relative to that of other professional women. Yet, these estimates of the impact of market competition on the gender gap might be upwardly-biased for several reasons mentioned above. To address these limitations, I use data from the Young Physicians Survey (YPS) to perform the same difference-in-difference analysis. Among this sample of young physicians, significant differences in demographic and labor market characteristics across men and women still exist but are smaller in magnitude than the CPS for some variables due to the characteristics of the population that was surveyed.[24] Yet large and significant differences persist across the specialties and practice settings of male and female physicians with women being more likely to be in lower-paid primary care specialties and men more likely to be in higher-paid medical and surgical specialties. Women physicians are also more likely to have salaried positions in institutionalized settings such as HMOs, hospitals, universities, public health clinics, and in government—work environments tend to offer more regular schedules, fewer hours, and an established patient base in exchange for less prestige and lower incomes. In contrast, male physicians are more likely to work in traditional solo or group practice office-based settings, which involve full or partial ownership of the practice. As of 1986, young female physicians earned 18 percent less in terms of hourly earnings—by 1990, that gap had narrowed to 14 percent.

6.1 Accounting for specialty and practice setting

[24] See the online data appendix for a table of summary statistics for the Young Physicians Survey.

Using the same differences-in-differences (DD) empirical approach as before, the YPS data confirm that increased market competition reduces the gender earnings gap. Table 5 reports both the dummy variable and continuous estimates of the impact of increasing market competition on the hourly earnings gap using equation (1) for the YPS.[25] The first row using the dummy variable approach shows that the hourly earnings gap between male and female physicians narrowed by 0.111 log points (11.8 percent) in states with above-average growth in HMO enrollments between 1986 and 1990 relative to those with below-average growth. Note that while these estimates are smaller in magnitude than those found using the CPS, this is likely due to the short time-period covered by the YPS. In fact, the point estimates for the continuous variable results are quite similar in magnitude. Controlling only for demographic and professional characteristics in column (1), a one percentage point increase in HMO market penetration is associated with a 2.0 percent increase in the earnings of female physicians relative to males compared to a 1.5 percent increase using the CPS.

Columns (2) and (3) of Table 5 add controls for medical specialty and practice setting respectively, which are important factors in explaining the gender gap among physicians. The growth in HMO market share continues to have a sizeable impact on the relative incomes and earnings of male and female physicians despite the addition of these controls. Including all controls, the YPS data indicate that the relative earnings of women physicians in states with high HMO market growth improved by 9.6 percent between 1986 and 1990 compared with the relative earnings of women physicians in states with low HMO market growth.

6.2 Accounting for incumbency and migration

[25] The results for annual earnings and hours worked per week are also similar to those reported using the CPS. See the appendix for these results.

It could be the case that the relative improvement in female earnings associated with managed care reflects only the experiences of new entrants to the physician labor market rather than that of existing incumbent workers. However, it could also be the case that new entrants are able to select better labor market conditions upon graduating from medical school, choosing to practice medicine in states where the return to their skills would be the highest. I test both of these possibilities using the longitudinal component of the Young Physicians Survey.[26] Despite the smaller sample size, the estimates for the incumbent workers are very similar to those reported for the cross-sectional sample.[27] To further eliminate the possibility of selection bias during the period, I restrict the panel sample to those physicians who did not migrate from either a low to a high managed care state or vice versa.[28] Again, the estimates are consistent with the theory that increasing market competition reduces the gender gap among physicians.

7. Testing mechanisms

Using data from the Young Physicians Survey, I explore three potential mechanisms underlying the relationship between changes in the market for physician services and the gender gap during the late 1980s and early 1990s. These include changes in productivity, changes in the demand for specialty and practice setting, and changes in the distribution of physician earnings.

7.1 Changes in productivity

HMOs dictate more uniform standards for medical practices and procedures—guidelines which may reduce pre-existing stylistic differences in how male and female physicians practice

[26] The 1991 YPS wave was composed of a random sample of physicians from the 1987 sample who were re-interviewed in 1991 as well as a new sample of young physicians under age 40 with 2-5 years of experience.
[27] Please see the online appendix for the results from the longitudinal sample.
[28] Of the individuals in 1986 who were re-interviewed in 1990, only 9 percent of the men and 8 percent of the women had migrated between states. Less than 5 percent of either sex had moved from a state with low managed care growth to a state with high managed care growth or vice versa during the intervening four years. Because there are so few movers, the impact of managed care on the gender earnings gap cannot be identified by comparing the experiences of those who moved.

medicine. Previous research found that some portion of the earnings differential between men and women physicians was attributed to women physicians seeing fewer patients per hour than men (Langwell 1982).[29] Other research finds that among physicians paid on a fee-for-service basis during the 1990s, women systematically provide fewer services than their male counterparts with almost any specialty (Constant and Léger 2008). Thus, through the use of treatment guidelines, productivity targets, utilization reviews, and selective contracting, HMOS may impose constraints on physicians that could reduce gender differences in productivity measures such as patients per hour.

To test this, Figure 3 plots the raw difference-in-differences (DD) estimates for both hours per week as well as patients per hour, for male and female physicians in 1986 and 1990 for states with above- versus below-average growth in HMO market shares. The number of hours worked per week by female physicians fell relative to males in both the high and low managed care states.[30] In addition, the allocation of those hours shifted such that the gender gap in patient care and administrative tasks narrowed over time in the states where HMO market share grew rapidly relative to that in the low-growth states. Yet there are no significant differences in the gender gap in patients per hour over time across the high- versus low-growth HMO states—even within specialty fields and practice settings. The one exception is for hospital based physicians where the gender gap in patients per hour in states with rapid increases in HMO market penetration instead *grew* relative to that in states with slower HMO market penetration (see Table 3). Based on this data, it seems unlikely that increased market competition arising from HMOs affected the gender earnings gap among physicians through changes in productivity. In

[29] One should keep in mind that this is an imprecise method of measuring productivity because it fails to account for differences in physician quality, case-mix, nonphysician labor inputs, and capital inputs, all of which have an impact on the ultimate productivity of a given medical practitioner.

[30] See the online appendix for a table showing the levels and changes over time for men and women in the high- and low-growth managed care states.

fact, women in the high-growth HMO states were more likely to report that they had the freedom to spend time with patients, and this gap narrowed over time relative to the low-growth HMO states.[31] Yet, without additional information on the comparative work practices of male and female physicians, it is difficult to entirely rule out this channel.

7.2 Changes in the demand for specialties and practice settings

HMOs also affect the relative demand for different specialties and/or alter the profitability of various practice settings in ways that favor female physicians. For example, HMOs encourage using less costly preventive care services, a shift that is likely to increase the relative demand for primary care physicians—medical specialties chosen by a high fraction of female physicians.[32] Previous research shows that an increase in HMO penetration of 0.10 between 1986 and 1996 reduced the rate of increase in medical/surgical specialists by 10.3 percent and increased the proportion of physicians who were generalists (Escarce et. al 2000). In addition, the incomes of primary care physicians rose more rapidly in states with high managed care growth while the incomes of specialists and hospital-based physicians were either unaffected or grew more slowly in such states (Simon, Dranove, and White 1998).

Similarly, managed care reimbursement practices typically transfer some of the risk for the cost of care from the managed care organization to the physician, making self-employment, a practice arrangement favored by male physicians, less profitable than in the past. During the 1990s, the net income of self-employed solo practitioners became roughly equivalent to that of employee physicians, reducing the financial incentives to set up one's own practice (Gonzalez

[31] See the online appendix for a table showing the responses to questions about time with patients and schedules.
[32] According to the American Medical Association, a primary care physician is a physician who "serves as the initial contact between the member and the medical care system" and is "responsible for coordinating the treatment of members assigned to his or her panel".

1998). Not coincidentally, AMA survey data show that the share of physicians who are self-employed dropped from 72 percent in 1988 to 58 percent in 1996.

Were market changes affecting the relative demand for different specialties and practice settings driving the overall improvement in the gender gap? To account for these compositional effects on the impact of managed care on the gender earnings gap, additional terms are added to the earlier dummy variable regressions from equation (1).[33] Table 6 reports the coefficient on the triple interaction term of female • 1990 • high growth managed care state—only with additional controls for primary care specialties and employee settings. In each case, the coefficient on the triple interaction for female is roughly equivalent to the original results from equation (1) shown in the first column, suggesting that broad shifts in demand for primary care specialties and employee settings do not play a significant role in the reduction of the gender earnings gap.

Perhaps these broad measures of composition are too course to detect a demand shift. The last column of Table 6 controls for the impact of changes in HMO market penetration separately on each primary care specialty (e.g. family/group practitioner, pediatrician, general internist) and each employee setting (e.g., HMO, hospital, government, and group practice). The results show that increasing HMO market share has a positive (although not statistically significant) effect on the hourly earnings of both pediatricians and general internists, reducing the coefficient on the main effect in both magnitude and significance.[34] In contrast, there is a strong and negative effect on the hourly earnings of employee physicians, especially those working in group practices, perhaps due to fewer new physicians being placed on the partnership track (Kostreski 1996).

[33] See the online appendix for the details of this specification.

[34] Consistent with the findings of Simon et al. (1998), limiting the sample to only primary care physicians (PCPs) shows that the impact of managed care on the relative earnings of women is stronger *within* this group. This is not surprising given that PCPs, compared to specialists, receive a greater percentage of their revenue from managed care and are more likely to derive at least some revenue from capitation (Strunk and Reschovsky 2002). Thus the compression effects of managed care are likely to be greater on the distribution of earnings for primary care physicians.

However, controlling for the negative effects of HMO market penetration on employee physicians does not diminish the main effect on the earnings of all female physicians.

7.3 Changes in reimbursement practices reduce economic rents

Managed care organizations such as HMOs have an immediate impact on the incomes of physicians who contract with them and thus may affect the relative position of women within the distribution of physician earnings. Reimbursement practices such as capitation (fixed fee per enrollee) or discounted fee-for-service arrangements place greater constraints on the fees physicians can charge compared with traditional fee-for-service arrangements. For example, Baker (1994) finds that in areas with greater HMO market penetration, physicians charge lower fees for a routine office visit with an established patient. Compensation may also be linked to the physician's pattern of clinical decision making and/or resource utilization, effectively limiting the ability of physicians to provide care beyond what is considered "medically necessary." Thus, assuming that some physicians were able to earn economic rents in the past, managed care may have limited the hourly earnings of high-rent (high-fee) physicians, a disproportionate fraction of whom would have been men. This implies that as managed care penetration increases, one should observe a decline in the gender gap in hourly earnings as well as a reduction in the dispersion of hourly earnings among male physicians.

To determine what proportion of the change in the gender earnings gap among physicians can be attributed to gender-specific factors, such as improvements in labor market qualifications or reduced discrimination, versus changes in the overall distribution of physician earnings, I decompose the gap using a technique pioneered by Juhn, Murphy, and Pierce (1991), and re-write the male-female log earnings gap for year t as:[35]

[35] See the online appendix for further details on the Juhn, Murphy, Pierce (1991) decomposition.

$$D_t = Y_{mt} - Y_{ft} = \Delta X_t B_t + \Delta \theta_t \sigma_t , \quad (2)$$

where θ_{it} is a standardized residual with mean zero and variance one in each year, and σ_t is the residual standard deviation of male earnings for that year which represents the level of male residual earnings inequality. Note that this technique assumes that the estimated male-denominated prices of both measured and unmeasured characteristics will affect men and women similarly.[36] The difference in the gender earnings gap between years 0 and 1 can then be decomposed as:

$$D_1 - D_0 = (\Delta X_1 - \Delta X_0)B_1 + \Delta X_0(B_1 - B_0) + \Delta \theta_0(\sigma_1 - \sigma_0) + (\Delta \theta_1 - \Delta \theta_0)\,\sigma_1. \quad (3)$$

The first term in equation (3) reflects the contribution of changing male-female differences in observed labor market qualifications such as experience, board certification, medical specialty, and practice setting. Given the rather short four-year time horizon separating the 1997 and 1991 YPS, this factor is expected to account for only a small part of the improvement in the earnings gap. The second term reflects the impact of changing prices for these observed labor market qualifications on males. For example, given that women physicians are less likely to be self-employed, a decrease in the male return to self-employment would weigh the female self-employment deficit less heavily. The third term measures the contribution to the change in the gap that would result if the percentile rankings of the female residuals had remained the same and only the degree of the male residual earnings inequality had changed. The last term measures the effect of changing differences in the relative wage positions of men and women after controlling for observable characteristics. It represents the contribution to the

[36] Suen (1997) has criticized this technique as misleading in its interpretation of the decomposition of the wage residuals into a portion reflecting the prices versus the quantities of unmeasured skills for low-wage groups such as women. However, Blau and Khan (2003) implement a more direct test of these relationships and find empirical evidence to support their earlier findings using the Juhn, Murphy, and Pierce decomposition.

change in the gap that would result if the level of residual male wage inequality had remained the same and only the percentile rankings of the female earnings residuals had changed.

Table 7 shows the above decomposition of the *change* in the hourly earnings gap among physicians between 1986 and 1990. The top half of the table that the male residual standard deviation of earnings fell by roughly 0.03 log points in the high-growth states but increased by approximately 0.04 log points in the low-growth states. In contrast, the female residual standard deviation was relatively stable for both high- and low-growth states. Combined, these results suggests that increased market competition may have compressed the earnings distribution of physicians in the upper tail, a disproportionate fraction of whom were males.

Moreover, the top half of Table 7 also indicates that the relative position of women within the male earnings distribution in states with greater HMO penetration also changed. Specifically, the mean female residual from the male earnings equation increased by 0.08 log points for women in the high-growth states but was virtually unchanged in the low-growth states.[37] This corresponds to women in the high-growth states moving from roughly the 47th percentile to the 50th percentile of the male earnings distribution. In contrast, the percentile ranking of women in the low-growth states was virtually unchanged over time.

The lower half of Table 7 decomposes the change in the gender earnings gap into the change in observed characteristics $(\Delta X_1 - \Delta X_0)B_1$, the change in observed prices of those characteristics $\Delta X_0(B_1 - B_0$, the change in the dispersion of the wage distribution $\Delta\theta_0(\sigma_1 - \sigma_0)$, and the change in the relative positions of men and women within the distribution $(\Delta\theta_1 - \Delta\theta_0)\,\sigma_1$. The results show that in the states with more rapid growth in HMO market shares, very little of

[37] This residual is the conventional measure of discrimination, although it may also include omitted productivity differences between women and men not accounted for by other explanatory variables.

the change in the gender earnings gap was due to changes in observed characteristics or the observed prices accruing to those characteristics.

What about the other two terms? Had each female physician remained at her 1986 percentile in the male earnings distribution, the male-female differential would have decreased by about 0.02 log points. However, women physicians practicing in the high growth states in fact moved up to form the 47^{th} to the 50^{th} percentile in the male residual earnings distribution. Holding the level of male residual earnings inequality constant, this upward movement reduced the gender earnings gap by about 0.053 log points, accounting for about one-third of the improvement in the gender earnings gap among physicians in the high-growth managed care states. The remaining two-thirds is attributed to gender-specific factors that moved women up within the male earnings distribution.

8. Concluding Remarks

The evidence presented in this paper suggests that changes in product market competition can have a sizeable impact on the gender earnings gap in professional occupations. Using the cross-state variation in HMO market penetration as a proxy for increasing competition in healthcare, I find that a one percentage point increase in HMO market penetration is associated with a 1.5 percent increase in the hourly earnings of female physicians relative to males—improving the gender gap among physicians by roughly 40 percent between 1980 and 1999. Moreover, between 2000 and 2007 when HMO enrollments were declining, the gender gap among physicians widened significantly by almost 25 percent. Performing the same analysis for lawyers or other professionals with advanced degrees demonstrates that the gender earnings gap for these groups did *not* narrow more rapidly in states with high managed care growth, confirming that the impact on physicians does not simply reflect other factors would lead to improvements in the relative earnings of all professional women.

Further analysis shows that increased market competition appears to affect the relative earnings of male and female physicians by reducing the ability of males to earn economic rents as demonstrated by the compression in the overall distribution of physician earnings. Female physicians in the high-growth HMO states moved up in the male residual earnings distribution while the earnings of female physicians fell in low-growth HMO states. Decomposing the gender earnings gap shows that changes in the wage structure can account for about one third of the improvement in the gender earnings gap among physicians in states with rapid increases in HMO market shares. The remaining two-thirds are attributed to gender-specific factors which moved women up in the male earnings distribution. These gender-specific factors reflect, in part, the impact of rising HMO market shares on the relative demand for pediatricians and general internists—a specialty favored by female physicians. Yet I find no evidence that HMO penetration affects the gender gap among physicians through changes in the relative productivity of male and female physicians—at least not in terms of the number of patients seen per hour. Without additional information on the clinical practices of male versus female physicians it is difficult to completely rule out this mechanism.

Finally, persistent discrimination against women physicians has been well-documented by the medical literature and has been shown to affect not only hiring practices, but also patient preferences and colleague interactions (Gravellea et. al. 2011, Tesch et al. 1995; , Thorne 1994; Shiffman and Frank 1995; Lenhart et al. 1991; Weyrauch et al 1990). It is possible that HMOs may have also limited the ability of consumers to discriminate against women physicians, by requiring enrollees to select physicians within the network who are still taking new patients. Likewise, colleagues contracting with HMOs may have been less able to discriminate against female physicians due to limitations on referrals to other physicians within the HMO network. Yet, I find that the gender gap narrowed less in specialties where there was a pre-existing

preference for male physicians—such as surgical and internal medicine sub-specialties—and less in physicians not subject to referral constraints such as solo practitioners, suggesting little role for changes in discrimination on the part of consumers and colleagues.[38]

In summary, the evidence presented in this paper clearly demonstrates that the spread of managed care, as proxied by the increase in HMO market penetration, had a significant impact on improving the relative earnings of women physicians. More broadly, these results suggest that increasing market competition can have important consequences for the gender earnings gap when there are large pre-existing differences between men and women within a profession.

[38] See the online appendix for results by different groups of female versus male preferred specialties.

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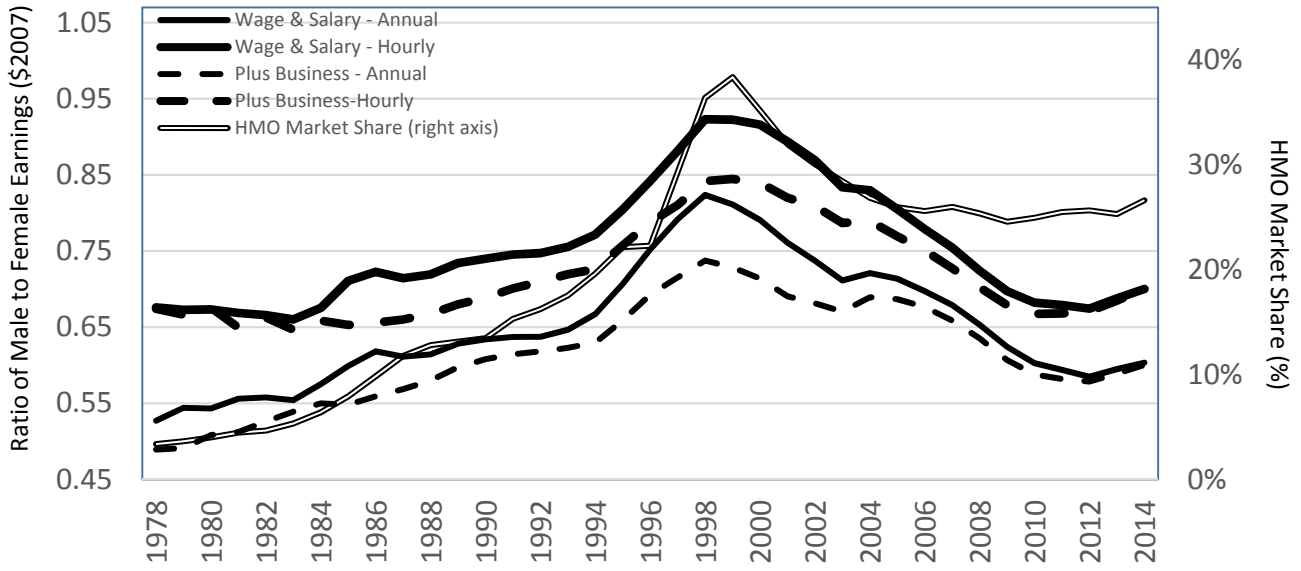
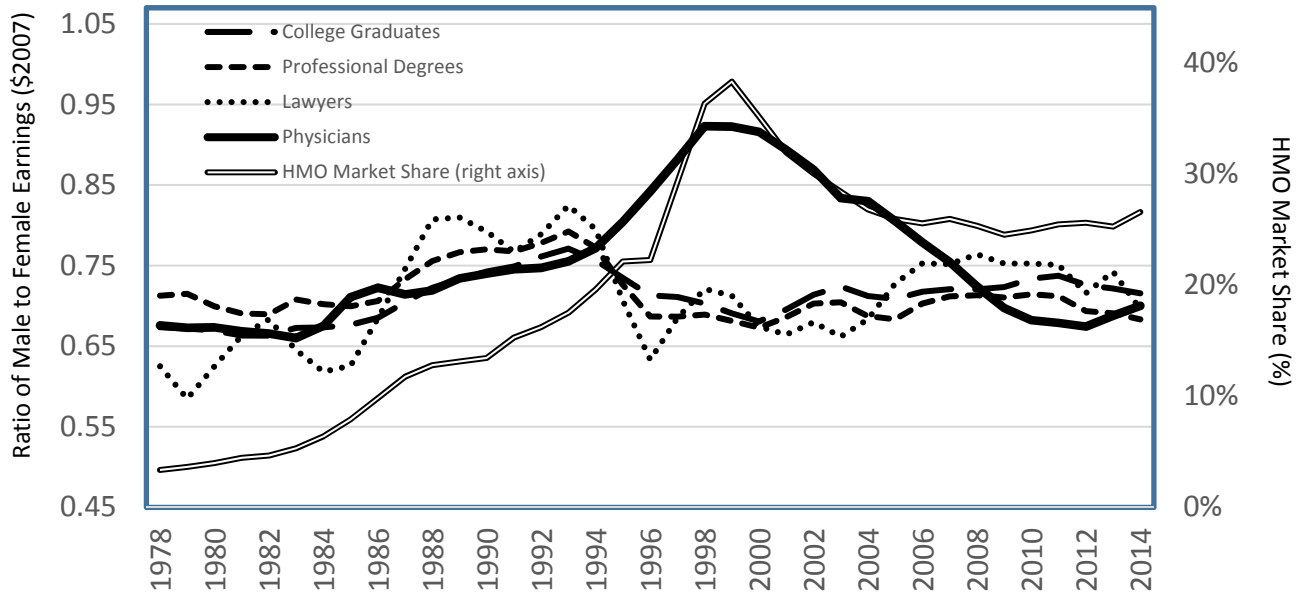
Figure 1. Gender gap among physicians and HMO penetration, 1978-2014

A. Earnings of physicians versus HMO market penetration



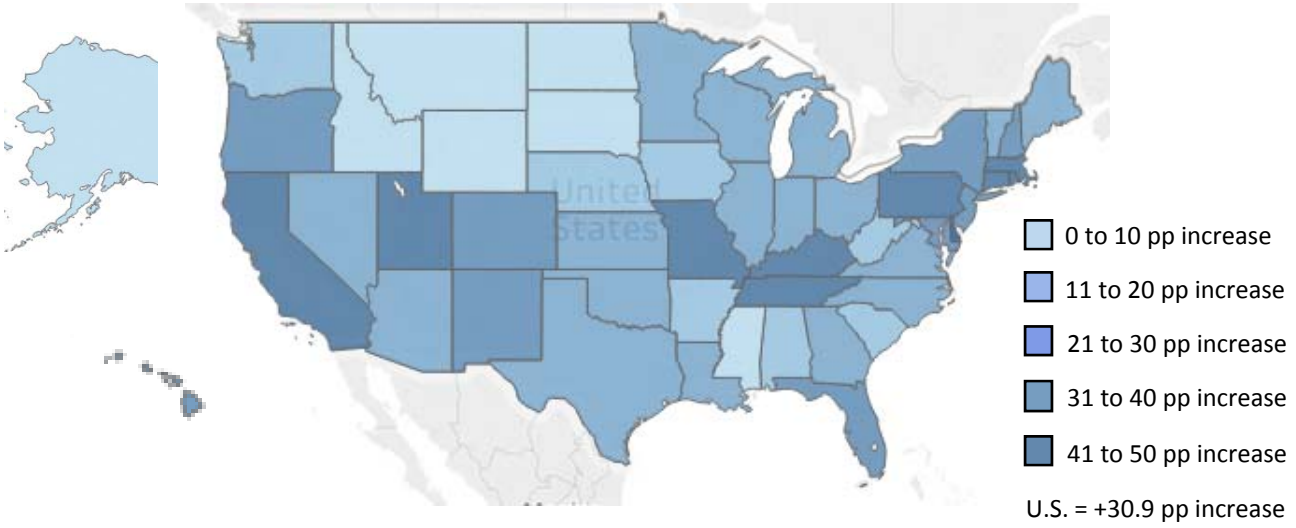
B. Hourly earnings of physicians versus other groups



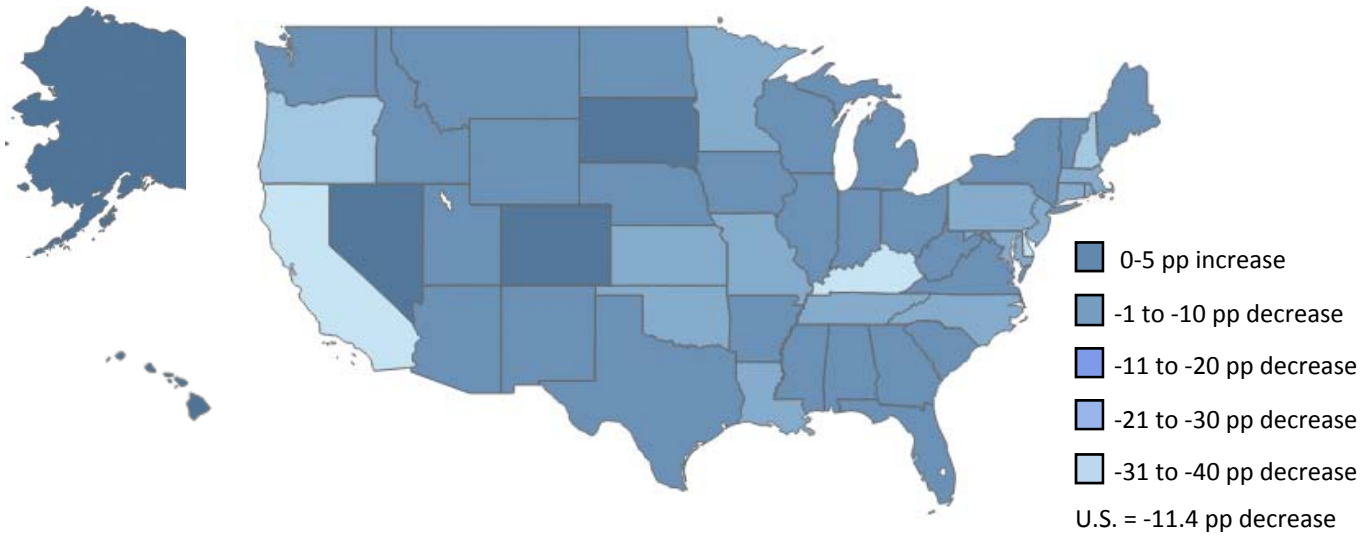
Notes: Sample is restricted to individuals working 20 hours per week and 26 weeks per year. College graduates are defined as those individuals having at least 16 year of education or a Bachelor's degree. Professional degree holders are those individuals with at least 18 years of education or a Master's, MBA, or JD degree. Physicians are defined as those listing physician as their occupation and having at least 20 years of education or an MD. Lawyers are defined as those listing lawyer as their occupation and having at least 19 years of education or a JD. Gender gap is the ratio of female to male real earnings ($2007). Data are pooled into overlapping five-year intervals centered on the observation year to ensure sufficient sample size for calculating the gender gap. Sources: Author's calculations from the Current Population Survey and the HMO-PPO Digest, various years.

Figure 2. Change in HMO market penetration by state

A. Change in HMO market share, 1980-99



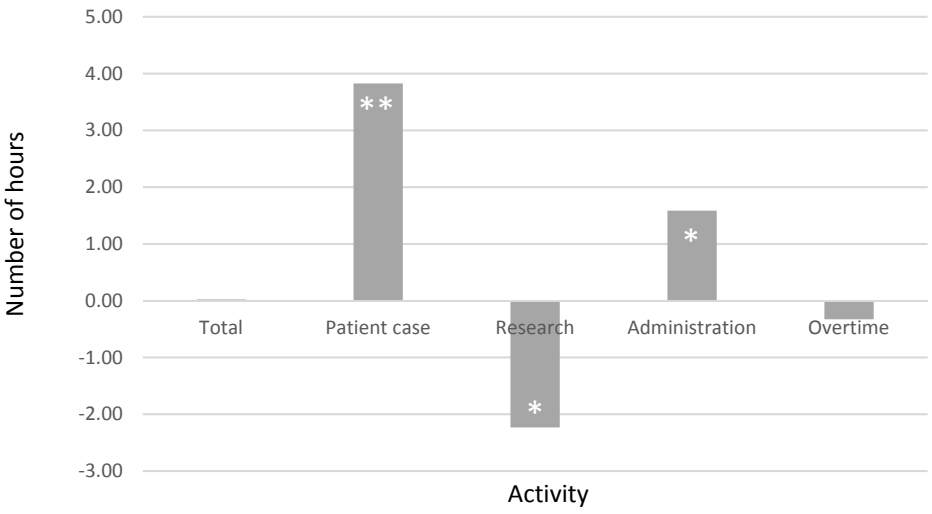
B. Change in HMO market share, 1999-2007



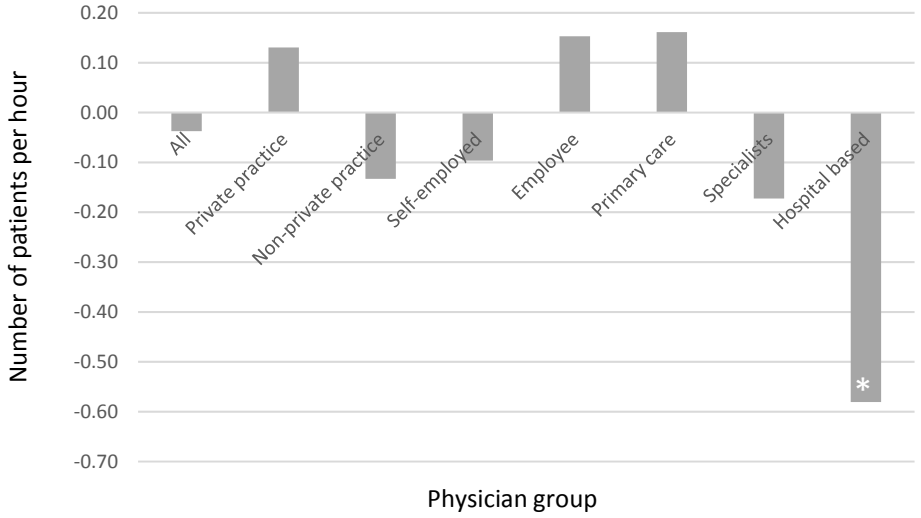
Notes: Market share is calculated as HMO enrollments as a percent of state population. Source: Author's calculations from the HMO-PPO Digest, various years.

Figure 3. Changes in Productivity for Young Physicians, 1986 versus 1990

A. DDD estimates of hours per week spent in various activities



B. DDD estimates of patients per hour



Notes: In each year, physicians who were no longer practicing or who were still in a training program were excluded from the sample. Physicians who worked less than 20 hours per week or 26 weeks per year, or had hourly wages below the minimum wage were also excluded.. *Indicates significance at the 10% level, **at the 5% level, ***at the 1% level.
Sources: Young Physicians Survey, various years.

Table 1
Descriptive statistics for male versus female physicians over time

	1980			1999			2007		
	Men	Women	Difference	Men	Women	Difference	Men	Women	Difference
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Demographics									
Age	41.411	38.601	-2.810 ***	43.670	39.040	-4.630 ***	45.946	41.711	-4.235 ***
	(10.411)	(10.785)	(0.872)	(9.453)	(8.438)	(0.568)	(9.920)	(9.399)	(0.400)
Black	0.029	0.053	0.024	0.033	0.050	0.017	0.044	0.072	0.028 ***
	(0.168)	(0.225)	(0.004)	(0.180)	(0.219)	(0.011)	(0.206)	(0.259)	(0.009)
Hispanic	0.035	0.025	-0.010	0.040	0.035	-0.005	0.050	0.042	-0.008
	(0.184)	(0.158)	(0.019)	(0.197)	(0.184)	(0.015)	(0.218)	(0.201)	(0.010)
Married	0.833	0.647	-0.185 ***	0.841	0.699	-0.142 ***	0.835	0.720	-0.115 ***
	(0.373)	(0.478)	(0.031)	(0.365)	(0.459)	(0.023)	(0.371)	(0.449)	(0.016)
Has a child	0.664	0.458	-0.206 ***	0.627	0.545	-0.082 ***	0.612	0.577	-0.035 **
	(0.472)	(0.498)	(0.039)	(0.484)	(0.498)	(0.030)	(0.487)	(0.494)	(0.020)
Lives in urban area	0.288	0.334	0.046 *	0.255	0.381	0.126 ***	0.319	0.350	0.032 *
	(0.453)	(0.472)	(0.037)	(0.436)	(0.486)	(0.027)	(0.466)	(0.477)	(0.019)
Labor Market Characteristics									
Weeks worked per year	50.985	49.424	-1.561 ***	51.351	50.361	-0.990 ***	51.239	50.261	-0.979 ***
	(3.893)	(6.764)	(0.371)	(2.979)	(0.486)	(0.222)	(3.496)	(5.477)	(0.167)
Hours worked per week	58.145	53.268	-4.876 ***	58.100	54.107	-3.993 ***	54.763	48.256	-6.507 ***
	(16.097)	(18.793)	(1.377)	(14.742)	(17.218)	(0.943)	(14.635)	(14.671)	(0.629)
Works full time	0.989	0.932	-0.057 ***	0.988	0.924	-0.064 ***	0.963	0.882	-0.081 ***
	(0.103)	(0.252)	(0.011)	(0.110)	(0.265)	(0.010)	(0.188)	(0.322)	(0.010)
Self-employed	0.265	0.183	-0.082 **	0.384	0.201	-0.183 ***	0.293	0.186	-0.107 ***
	(0.441)	(0.387)	(0.037)	(0.486)	(0.401)	(0.029)	(0.455)	(0.389)	(0.019)
Earnings (Real $2007)									
Annual earnings	$112,076.90	$65,455.19	-$46,621.71 ***	$182,473.00	$140,304.60	-$42,168.40 **	$209,061.50	$119,246.0	-$89,815.50 ***
	($64,887.30)	($43,943.81)	($5,287.41)	($152,072.80)	($124,574.60)	($16,323.41)	($191,522.90)	($94,230.35)	($12,077.11)
Unadjusted ratio: Female/Male			0.584			0.769			0.570
Hourly earnings	$40.66	$27.01	-$13.64 ***	$65.72	$57.19	-$8.53	$77.794	$52.576	-$25.22 ***
	($25.49)	($19.95)	($2.12)	($56.48)	($49.49)	($6.28)	($73.09)	($49.19)	($4.84)
Unadjusted ratio: Female/Male			0.664			0.870			0.676
Number of Observations	1,247	161	1,408	1,135	345	1,480	1,703	779	2,482

Notes : The sample is comprised individuals, age 25 to 64, who listed their occupation as physician and also possess an advanced degree (having 18 years of education in the 1980 Census or having earned a master's, doctorate, or professional degree). The sample excludes individuals who were not in the labor force, worked less than 26 weeks per year or 20 hours per week, or had hourly wages less than the minimum wage. *Indicates significance at the 10% level, **at the 5% level, and ***at the 1% level. Sources: Current Population Survey, various years.

Table 2
Differences in differences estimates of the impact of positive versus negative changes in HMO growth on the gender gap among physicians

	Positive HMO growth: 1980 versus 2000			Negative HMO growth: 2000 versus 2007		
	States with above averge increase in HMO market share DD: Female-Male (1)	States with below averge increase in HMO market share DD: Female-Male (2)	DDD: High-Low (3)	States with above averge decrease in HMO market share DD: Female-Male (4)	States with below averge decrease in HMO market share DD: Female-Male (5)	DDD: High-Low (6)
Log annual earnings	0.266 **	-0.177	0.443 **	-0.136 **	0.156	-0.292 **
	(0.115)	(0.149)	(0.187)	(0.061)	(0.096)	(0.124)
Log hourly earnings	0.219 **	-0.258	0.477 **	-0.115 **	0.128	-0.222 **
	(0.103)	(0.169)	(0.196)	(0.057)	(0.079)	(0.110)
Log weekly hours	0.015	0.022	-0.007	-0.033	0.001	-0.034
	(0.056)	(0.055)	(0.078)	(0.032)	(0.047)	(0.047)

Notes: See Table 1 for sample restrictions. Data are pooled at five-year intervals around each year (e.g. 1978-82 (CPS years 1979-83) for 1980). Annual income and hourly wages are adjusted for inflation using the PCE index and are reported in $2007. States with high positive or negative managed care growth are defined as those with a percentage point increase or decrease in HMO enrollment as a percentage of population greater than the national average. For 1980 versus 1990 the high positive growth states include Arizona, California, Colorado, Connecticut, Delaware, District of Columbia, Illinois, Maryland, Massachusetts, Michigan, New Jersey, New Mexico, Ohio, Oregon, Pennsylvania, Rhode Island, Utah, and Wisconsin. All other states are regarded as those with low managed care growth. For 1999 versus 2006 the high negative growth states include Colorado, Delaware, Florida, Kentucky, Lousiana, Massachusetts, Minnesota, Missouri, New Hampshire, New Jersey, Tennessee, Oregon, Pennsylvania, Rhode Island, and Utah. Robust standard errors are given in parentheses directly below the coefficients. *Indicates significance at the 10% level, **at the 5% level, and ***at the 1% level. Source: Current Population Survey and HMO-PPO Digest, various years.

Table 3
Regression estimates of the impact of HMO growth on the gender earnings gap for physicians: 1980 versus 1999

	Coefficient on Female*Time period*HMO growth			
	(1)	(2)	(3)	(4)
Dependent variable				
Log annual earnings	0.014 **	0.018 ***	0.018 **	0.018 **
	(0.007)	(0.008)	(0.008)	0.007
Evaluated for high versus low growth states	0.317	0.418	0.418	0.418
Log hourly earnings	0.012 **	0.016 **	0.016 **	0.015 **
	(0.006)	(0.008)	(0.008)	0.008
Evaluated for high versus low growth states	0.270	0.358	0.358	0.346
Log weekly hours	0.002	0.001	0.001	0.003
	(0.003)	(0.003)	(0.003)	(0.002)
Evaluated for high versus low growth states	0.039	0.033	0.033	0.058
Controls				
Controlling for demographic characteristics		X	X	X
Including state fixed effects			X	X
Instrumenting for HMO growth				X
First stage F-statistic				74.54
Number of observations	2,888	2,888	2,888	2,888

Notes: See Table 1 for sample restrictions. Data are pooled for 1978-82 (CPS years 1979-83) for 1980 and 1997-01 (CPS years 1998-02) for 1999. Annual income and hourly wages are adjusted for inflation using the PCE index and are reported in $2007. The coefficient reported in the the table is that on the triple interaction: female*time*HMO growth in the state of residence where time is a dummy variable for the later period 1997-01. All regressions include a female dummy variable, a time dummy variable for the later period (1997-01), and the growth in HMO enrollments. Second level interactions are captured by interacting HMO growth with the time and female dummies separately, as well as interacting the female and time dummies. Demographic characteristics include experience and it square (calculated as age minus years of education), race, ethnicity, marital status, children, and living in an urban area. Estimates are evaluated at the mean difference in growth between high and low growth states for comparison with dummy variable DD estimates in Table 3. Robust standard errors, clustered by state, are in parentheses. *Indicates significance at the 10% level, **at the 5% level, and ***at the 1% level. Sources: Current Population Survey and HMO-PPO Digest, various years.

Table 4
Impact of HMO growth on the gender earnings gap for physicians compared to other professionals: 1980 versus 1999

	Log Annual Earnings		Log Hourly Earnings		Log Weekly Hours
	(1)		(2)		(3)
DDD: Female * time * HMO growth					
Physicians	0.018	**	0.016	**	0.001
	0.008		0.008		0.003
All college graduates	-0.002		-0.002		0.000
	(0.002)		(0.002)		(0.001)
All professionals with advanced degrees (excluding physicians)	0.000		-0.001		0.000
	(0.003)		(0.003)		(0.001)
All lawyers	0.001		0.008		0.001
	(0.018)		(0.018)		(0.003)
DDDD: Female * time * HMO growth * physician					
Physicians versus all college graduates	0.020	**	0.019	*	-0.001
	(0.008)		(0.010)		(0.004)
Physicians versus other professionals with advanced degrees	0.020	**	0.019	*	-0.001
	(0.008)		(0.011)		(0.004)
Physicians versus lawyers	0.020	**	0.014	*	-0.001
	(0.010)		(0.009)		(0.004)

Notes: See Table 1 for sample restrictions. Data are pooled for 1978-82 (CPS years 1979-83) for 1980 and 1997-01 (CPS years 1998-02) for 1999. Annual income and hourly wages are adjusted for inflation using the PCE index and are reported in $2007. The coefficient reported in the the table is that on the triple interaction: female*time*HMO growth in the state of residence where time is a dummy variable for the later period 1997-01. All regressions include a female dummy variable, a time dummy variable for the later period (1997-01), and the growth in HMO enrollments. Second level interactions are captured by interacting HMO growth with the time and female dummies separately, as well as interacting the female and time dummies. Demographic characteristics include experience and it square (calculated as age minus years of education), race, ethnicity, marital status, children, and living in an urban area. Estimates are evaluated at the mean difference in growth between high and low growth states for comparison with dummy variable DD estimates in Table 3. Robust standard errors, clustered by state, are in parentheses. *Indicates significance at the 10% level, **at the 5% level, and ***at the 1% level. Sources: Current Population Survey and HMO-PPO Digest, various years.

Table 5
Regression estimates of the impact of HMO growth on the gender earnings gap for young physicians: 1986 versus 1990

	Coefficient on Female * 1990 *HMO Growth			
	(1)	**(2)**	**(3)**	**(4)**
Dependent Variable = Hourly Earnings				
Dummy Variable Estimates	0.111 **	0.093 **	0.122 **	0.100 **
	(0.050)	(0.047)	(0.049)	(0.046)
Continuous Variable Estimates	0.020 **	0.016 **	0.023 ***	0.019 ***
	(0.007)	(0.007)	(0.008)	(0.007)
Evaluated for high versus low growth states	0.104	0.083	0.121	0.096
Instrumental Variables Estimates	0.019 **	0.015 **	0.024 ***	0.019 ***
	(0.008)	(0.007)	(0.008)	(0.007)
Evaluated for high versus low growth states	0.100	0.077	0.124	0.098
Controls				
Demographic and Professional Characteristics	X	X	X	X
Specialty Field		X		X
Practice Setting			X	X
Number of Observations	6198	6198	6198	6198

Notes: In each year, physicians who were no longer practicing, who were still in a training program were excluded from the sample. Physicians who worked less than 20 hours per week or 26 weeks per year, or had hourly wages below the minimum wage were also excluded.. All regressions include a full set of state dummy variables, a dummy variable for 1990, and a female dummy variable. The second level interactions are captured by interacting each state dummy with the 1990 dummy and the female dummy separately, as well as interacting female and time. Demographic and professional characteristics include age, race, ethnicity, board certification, experience and its square, marital status and children. Specialty choice includes 10 categories where family/general practice is the omitted category. Practice setting includes 7 categories where group practice with part ownership is the omitted category. Robust standard errors, clustered by state, are in parentheses. *Indicates significance at the 10% level, **at the 5% level, ***at the 1% level. Sources: Young Physicians Survey, various years.

Table 6
Accounting for shifts in demand for specialty and practice setting on the gender earnings gap for young physicians: 1986 versus 1990

	Dependent Variable = Log Hourly Earnings		
	Coefficient on Dummy Variable with 1990*High Growth Managed Care State		
Including Primary Care Specialty Interactions			
Female	0.100 **	0.096 **	0.084 *
	(0.046)	(0.048)	(0.050)
Primary Care Physician	-----	0.011	-----
		(0.063)	
Family/Group Practitioner	-----	-----	-0.064
			(0.096)
Pediatrician	-----	-----	0.068
			(0.100)
General Internist	-----	-----	0.027
			(0.076)
Including Employee Setting Interactions			
Female	0.100 **	0.110 **	0.102 **
	(0.046)	(0.047)	(0.046)
Employee Physician	-----	-0.063	-----
		(0.071)	
HMO Employee	-----	-----	-0.047
			(0.112)
Hospital Employee	-----	-----	-0.034
			(0.116)
Government Employee	-----	-----	-0.062
			(0.150)
Group Practice Employee	-----	-----	-0.105
			(0.082)
Including Both Sets of Interactions			
Female	0.100 **	0.103 **	0.107 **
	(0.046)	(0.049)	(0.047)
Primary Care Physician	-----	0.012	-----
		(0.063)	
Employee Physician	-----	-0.069	-----
		(0.071)	-0.057
Primary Care * Employee Physician	-----	-----	(0.072)
Number of Observations	6198	6198	6198

Notes: In each year, physicians who were no longer practicing or who were still in a training program were excluded from the sample. Physicians who worked less than 20 hours per week or 26 weeks per year, or had hourly wages below the minimum wage were also excluded.. All regressions include a full set of state dummy variables, a dummy variable for 1990, and a female dummy variable. The second level interactions are captured by interacting each state dummy with the 1990 dummy and the female dummy separately, as well as interacting female and time. Including primary care specialty interactions means that the regression also includes dummy variables for primary care specialties as well as interactions between 1990 and whether or not the physicians practices in a high managed care state with those variables.The coefficient reported is that on the triple interaction term of the primary care dummy * 1990 * high growth managed care state. Employee setting interactions are defined analogously. Demographic and professional characteristics include age, race, ethnicity, board certification, experience and its square, marital status and children. Specialty choice includes 10 categories where family/general practice is the omitted category. Practice setting includes 7 categories where group practice with part ownership is the omitted category. Robust standard errors, clustered by state, are in parentheses. *Indicates significance at the 10% level, **at the 5% level, ***at the 1% level. Sources: Young Physicians Survey, various years.

Table 7
Decomposition of Changes in the Gender Earnings Gap Among Physicians, 1986-90

	States with Low Managed Care Growth	States with High Managed Care Growth	Difference (High - Low)
Descriptive Statistics			
Male residual standard deviation[a]			
1986	0.4878	0.4974	0.0096
1990	0.5200	0.4602	-0.0598
Female residual standard deviation[b]			
1986	0.4587	0.4505	-0.0082
1990	0.4555	0.4582	0.0027
Mean female residual from male wage regression			
1986	-0.0622	-0.0736	-0.0114
1990	-0.0638	0.0018	0.0656
Mean female residual percentile within male distribution[c]			
1986	46.1	47.2	1.1
1990	46.9	49.8	2.9
Decomposition of Change			
Change in differential	0.0561	-0.0736	-0.1297
Observed characteristics (X's)			
All characteristics	0.0273	0.0023	-0.0250
Demographic and professional variables	-0.0084	-0.0001	0.0083
Specialty field variables	0.0508	0.0227	-0.0281
Practice setting variables	-0.0151	-0.0203	-0.0052
Observed prices (B's)			
All prices	0.0272	-0.0005	-0.0276
Demographic and professional variables	-0.0070	-0.0035	0.0035
Specialty field variables	0.0115	-0.0084	-0.0198
Practice setting variables	0.0227	0.0113	-0.0113
Dispersion of the distribution	0.0024	-0.0225	-0.0249
Relative positions of men and women within distribution	-0.0008	-0.0530	-0.0522
Sum wage structure	0.0296	-0.0230	-0.0525
Sum gender-specific	0.0265	-0.0506	-0.0772
Total	0.0561	-0.0736	-0.1297

Notes: In each year, physicians who were no longer practicing or who were still in a training program were excluded from the sample. Physicians who worked less than 20 hours per week or 26 weeks per year, or had hourly wages below the minimum wage were also excluded. The change in the differential is the change in the male-female log wage differential between 1986 and 1990. X is a vector of explanatory variables, B is a vector of estimated coefficients from the male wage equation.

[a]Estimated using male wage regressions. [b]Estimated using female wage regressions. [c]Computed by assigning each woman a percentile ranking in the indicated year's residual male wage distribution and calculating the female mean of these percentiles.