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US physician board certification and labor market returns

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Abstract

Purpose – This paper aims to determine the characteristics of board certification among US physicians and to test whether accounting for the expected gains to certification alters the pattern of the determinants of board certification.

Design/methodology/approach – Splitting the sample into sub-samples by characteristics associated with certification/non-certification identified in a probit, the incremental gain to certification from log-earnings equations is identified. Realizing that these methods are susceptible to sample selection, correction is made for it using the Heckman approach. Using the sample selection corrected equations, the expected gain to certification among those who certify is then predicted and those who do not certify is then predicted and this difference is included as a proxy for the expected gain in the original probit to ascertain whether including the expected gain alters the determinants of certification.

Findings – Accounting for the expected gain alters the pattern of the determinants of certification. Although some groups such as blacks appear less likely to certify, after accounting for their expected return to certification, they are not as less likely. This is explained in terms of the expected marginal return to certification, market structure and practice setting.

Research limitations/implications – The data used in the analysis apply only to young physicians in the USA. Also, these results may be applicable only to the particular cohort used in this analysis.

Practical implications – The findings help to explain the absence of minority board certified physicians within the USA.

Originality/value – This paper is the first to simultaneously estimate the returns to physician board certification and the decision to obtain certification.

Keywords Qualifications, Human capital, Labour market, Race relations

Paper type Research paper

Introduction

This paper simultaneously estimates the returns to physician board certification and the decision to obtain certification. We confirm that those physicians with the highest expected returns to certification are more likely to obtain certification. These physicians operate in competitive environments, are married, white, experienced and within a specific subset of specialties. Critically, we identify the importance of sample selection on certification in estimating physician earnings and show that accounting

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The authors wish to dedicate this paper to Wilma O'Halloran whose passion for education touched everyone she selflessly reached.

for the expected earnings gain alters the pattern of the determinants of certification. Although blacks appear less likely to be certified without such accounting, after accounting for their expected return to certification they are not as less likely than whites to become certified.

Although there are a few studies examining the returns to physicians from medical board certification (Wilensky and Rossiter, 1983; Langwell, 1979; Owens, 1978; Kehrer, 1976), none have simultaneously evaluated the returns to certification and the decision to invest in certification. Because board certification is not required to practice, the decision to certify must be linked to the rewards received from certification. The decision to become board certified in a particular specialty is closely related to the decision to become specialized as a physician: additional education and training costs are balanced against the anticipated increased returns. The decision to become board certified is therefore a human capital decision.

The human capital theory suggests that increases in income from certification occur because of an investment in human capital that increases physician productivity. In contrast, the decision to certify may be driven by the returns that result from labor market signaling (Spence, 1973). The signaling hypothesis suggests that physician certification is an ability-signaling device that does not necessarily increase the physician's productivity but signals to potential patients (and employers) that the physician is of high ability.

In addition to the signaling hypothesis, many studies suggest that occupational licensing increases economic rents of those in certain occupations through restricted supply while not necessarily increasing the quality of service (Kugler and Sauer, 2005; Kleiner and Kudrle, 2000; Kleiner, 2000). The results from these studies are not applicable in this case because of the distinction between licensing and certification whereby licensing is legally necessary and certification is optional. The economic rents associated with certification are largely dependent on consumers (and employers) who correlate certification with quality of service. When certification is examined among teachers, economic rents are found to increase while quality of service is not enhanced (Angrist and Guryan, 2005). Regardless of the cause of returns to certification, this paper explores these returns as an incentive to obtain physician board certification.

In the case of specialty choice, a physician must consider the present value of their future income stream, since the decision to specialize represents a time consuming investment (Phelps, 1997). Some studies have examined the returns to specialization (Burstein and Cromwell, 1985; Sloan, 1970) while others have examined the returns to board certification (Hampton and Heywood, 1993, Wilensky and Rossiter, 1983; Kehrer, 1976). There are no studies that the authors are aware of that explicitly consider the interrelationship between the decision to become certified and the returns to certification. Furthermore, using this unique approach we are able to control for the affect of the expected gain to certification on the decision to obtain certification. This study identifies the weighing of expected returns and costs as a primary reason behind a physician's decision to become board certified in a respective specialty.

As minority physicians have lower expected gains from certification and this causes them to invest less in this certification, a possible policy implication could exist. To the extent that board certification improves physician quality, subsidies could be provided to non-white physicians who certify to defray the direct and indirect costs of this education. This, according to the human capital theory, should sway the cost-benefit

analysis associated with investment in human capital toward attainment. This may serve to improve the quality of healthcare given to minority patients in communities where sufficient patient-doctor racial matching exists.

Using a survey conducted by the American Medical Association (AMA) in 1991, groups of physicians are identified as being either more or less likely to invest their time in becoming board certified. These groups of physicians are further investigated to determine their financial returns to certification. When financial returns are inadequate in explaining the choice made, implicit and explicit costs associated with pursuing board certification are examined. Furthermore, we control for selectivity into certification and include as an explanatory variable the predicted earnings gain associated with certification. We convincingly show that those with the largest expected net gain to certification are more likely to obtain certification. Our analysis also shows that including the earnings gains to certification significantly alters the determinants of certification.

The following section describes the data and discusses the results of a probit estimation used to identify the physician characteristics that coincide with certification. The section entitled "Returns to board certification" examines the returns to certification within those sub-samples identified as more or less likely to become certified in the probit estimation. The section entitled "Costs of board certification" presents arguments consistent with costs associated with certification to explain why physicians in certain specialties are more apt to certify than others. "Selection correction" addresses selection correction issues associated with this study and reveals that controlling for the expected returns to certification substantially alters the determinants of certification. The conclusion provides some limitations and suggests some possible extensions.

Data and likelihood of certification

The data used in this study come from the AMA sponsored 1991 Survey of Young Physicians consisting of 6,053 randomly selected physicians[1]. The sample reflects a conscious effort by the principal investigator to over-sample minority physicians. Data collection originated from three distinct groups. First, information was collected from 2,313 randomly selected physicians born during, or after, 1952, and who completed residency training between the years 1986-1989. The next component of the overall sample was the result of an over-sampling of 616 minority physicians who satisfied the age and residency criteria above. Finally, the pool of respondents was completed with 3,124 physicians selected by taking a random sample of those who participated in the 1987 Survey of Young Physicians. The earlier survey consisted of a random sample of 5,865 physicians under the age of 40 with two to five years of experience as of 1987.

To ensure reliable analysis from the data, several exclusions are made. Physicians who were not practicing, or moved to another practice the previous year, were removed.

Physicians who were not practicing were excluded because their income from the previous year is not related to the practice of medicine. In trying to isolate the impacts of physician board certification, we must compare physicians who practice medicine with and without certification. The inclusion of those who do not practice medicine would cloud this comparison whether they are certified or not. The exclusion of those physicians who moved to another practice the previous year is based on the belief that

income may be affected by that move and may obscure the impacts of physician board certification. The authors admit that these exclusions may bias the results somewhat but believe that the exclusions are justified.

Table I lists the variables pertinent to this study and their means by race and certification status. The most striking difference in these summary statistics is that the proportion of white physicians that are board certified is significantly higher (84.15 percent) compared to that of their non-white counterparts (67.29 percent). In addition, the certified physician's mean experience is greater than one year more than the non-certified physicians. This may simply reflect the fact that certification can take some time to complete and thus those with more experience are more likely to be certified. Interestingly, the certified physician's mean income is slightly greater than 14 percent higher than the non-certified physicians, which largely mirrors the income premium that white physicians receive over their non-white counterparts. These differences, although intriguing, are the result of many factors but it could be that they are somehow related.

As an initial investigation, several probit equations ware estimated to identify which types of physicians are more apt to become board certified. Due to the fact that many of the covariates may well be endogenous, we estimate several sequential specifications each including additional groupings of potentially endogenous variables. Results from these estimations are listed in Table II. Column 1 reports the results of a probit estimation on the likelihood of certification including only strictly exogenous variables such as race and gender as a base specification. As shown in Table II, Column 2-7, the addition of these potentially endogenous variables has little impact on the results obtained in the base specification presented in Column 1. We take this as support for the proposition that our results are insensitive to potential endogeneity.

The results imply that physicians in community health are 15 percent less likely, and those in government practice settings are 7.8 percent less likely to become board certified as their practicing colleagues. However, those who work in academic settings are 5.7 percent more likely to invest in board certification. In addition, minority physicians are 16.7 percent less likely to become certified than their Caucasian colleagues. The source of these differences in proclivity to certify are investigated by looking at incremental earnings associated with board certification within these groups.

The probit results further indicate that physicians of certain specialties are 4-20 percent less likely to become certified than those who are general family practitioners. This pattern roughly confirms previous results found by Hampton and Heywood (1993). Surgeons, anesthesiologists, obstetricians and gynecologists, psychiatrists and physicians who practice in the catch-all category of other specialties are less likely than general family practitioners to become board certified. The source of these differences in proclivity to certify are investigated based largely on the explicit and implicit costs associated with certification in these specialties.

Returns to board certification

Overall samples of physicians largely point to the fact that those physicians with board certification receive a substantial increase in earnings (see Hampton and Heywood, 1993; Wilensky and Rossiter, 1983; Kehrer, 1976). Kehrer (1976) found that board certified physicians earn around 20 percent more than their non-certified counterparts.

Variable	White mean	Non-whites mean	Certified mean	Non-certified mean
Board certified (%)	84.15	67.29	–	–
Male (%)	76.61	70.17	75.08	73.35
Black (%)	–	40.16	9.39	20.81
Hispanic (%)	–	40.46	10.28	17.85
Other non-white race (%)	–	19.39	5.22	7.45
Own part or all of practice (%)	50.41	46.82	50.19	46.19
Children under six years old in household (%)	86.84	82.41	85.03	87.48
Married (%)	85.97	79.89	85.74	78.26
Malpractice claim (%)	19.51	19.75	20.34	16.67
Income (thousands)	$236.48	$206.50	$233.68	$204.88
Parents' income class lower (%)	5.32	18.61	8.19	13.11
Parents' income class lower middle (%)	21.92	25.15	23.32	21.15
Parents' income class middle (%)	39.49	31.63	37.97	34.18
Parents' income class upper middle (%)	29.16	20.65	26.60	26.90
Parents' income class upper (%)	4.11	3.96	3.91	4.65
Hours per week	56.52	56.08	56.57	55.74
Weeks worked	47.10	47.46	47.11	47.57
Experience	5.49	5.64	5.76	4.69
Experience squared	35.32	36.53	37.88	27.29
Prior job (%)	40.83	46.04	43.06	39.68
Member of AMA (%)	43.67	35.71	41.95	39.00
Region				
Midwest (%)	23.89	16.15	21.92	20.47
South (%)	31.62	41.72	33.69	37.99
West (%)	19.16	22.15	20.65	17.68
Specialty				
Internal medicine (%)	25.16	27.49	26.12	24.79
Surgery (%)	16.15	12.73	15.15	15.14
Pediatrics (%)	9.63	14.83	11.79	8.71
OBGYN (%)	5.35	9.00	4.97	11.93
Radiology (%)	5.87	3.78	5.97	2.54
Psychiatry (%)	4.95	6.48	4.29	9.64
Anesthesiology (%)	6.20	4.80	5.37	7.36
Pathology (%)	3.21	2.40	3.46	1.10
Other specialty (%)	7.84	5.22	6.77	8.21
Practice settings				
Hospital[a] (%)	14.26	14.05	13.99	14.97
Academic[b] (%)	10.03	7.32	9.99	6.35
HMO (%)	3.41	6.24	4.42	3.55
Ambulatory Center (%)	1.52	3.00	1.82	2.45
For profit clinic (%)	0.47	0.54	0.47	0.59
Community health (%)	0.92	1.80	0.89	2.28
Government[c] (%)	6.25	9.30	6.22	10.66
Observations	4,019	1,666	4,503	1,182

Table I.
Summary statistics by race and certification status

Notes: [a] "Hospital" includes those practicing in hospitals or hospital clinics; [b] "Academic" includes those practicing in medical school or university settings; [c] "Government" includes those practicing in local, state or federal government facilities

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Male	0.005	−0.021	−0.017	−0.032	−0.056	−0.054	−0.059
	(0.11)	(0.47)	(0.36)	(0.67)	(1.14)	(1.09)	(1.19)
Black	−0.662	−0.643	−0.615	−0.593	−0.655	−0.635	−0.622
	(11.97)*	(11.53)*	(10.81)*	(10.30)*	(11.08)*	(10.43)*	(10.15)*
Hispanic	−0.514	−0.513	−0.533	−0.522	−0.526	−0.510	−0.511
	(9.21)*	(9.15)*	(9.31)*	(9.06)*	(8.97)*	(8.58)*	(8.50)*
Other non-white	−0.395	−0.421	−0.429	−0.434	−0.485	−0.476	−0.490
race	(5.04)*	(5.36)*	(5.33)*	(5.37)*	(5.89)*	(5.76)*	(5.88)*
Married		0.233	0.228	0.225	0.210	0.210	0.212
		(4.62)*	(4.45)*	(4.35)*	(3.97)*	(3.98)*	(4.02)*
Children < six		−0.145	−0.121	−0.114	0.080	0.078	0.075
years		(2.56)**	(2.11)**	(1.97)**	(1.32)	(1.28)	(1.24)
Specialty							
Internal		−0.204	−0.232	−0.239	−0.242	−0.236	
medicine		(3.06)*	(3.44)*	(3.49)*	(3.52)*	(3.42)*	
(General)							
Internal		0.192	0.140	0.308	0.301	0.314	
medicine		(1.29)	(0.94)	(2.01)**	(1.96)**	(2.04)**	
(Special)							
Surgery			−0.300	−0.355	−0.374	−0.373	−0.383
(General)			(3.07)*	(3.59)*	(3.69)*	(3.68)*	(3.76)*
Surgery (Special)			−0.237	−0.297	−0.256	−0.252	−0.272
			(2.90)*	(3.57)*	(2.99)*	(2.94)*	(3.14)*
Pediatrics			0.022	−0.014	−0.014	−0.015	−0.005
			(0.27)	(0.17)	(0.16)	(0.17)	(0.06)
OBGYN			−0.679	−0.738	−0.775	−0.777	−0.787
			(7.86)*	(8.40)*	(8.48)*	(8.48)*	(8.51)*
Radiology			0.212	0.164	0.108	0.101	0.098
			(1.85)	(1.42)	(0.90)	(0.84)	(0.81)
Psychiatry			−0.678	−0.669	−0.637	−0.635	−0.630
			(7.40)*	(7.19)*	(6.64)*	(6.60)*	(6.49)*
Anesthesiology			−0.439	−0.492	−0.526	−0.531	−0.544
			(4.72)*	(5.22)*	(5.39)*	(5.42)*	(5.54)*
Pathology			0.369	0.338	0.321	0.327	0.342
			(2.38)**	(2.18)**	(2.05)**	(2.08)**	(2.17)**
Other specialty			−0.380	−0.404	−0.405	−0.408	−0.416
			(4.36)*	(4.56)*	(4.50)*	(4.53)*	(4.61)*
Practice setting							
HMO				0.229	0.154	0.161	0.144
				(2.01)**	(1.32)	(1.37)	(1.21)
Hospital[a]				0.022	−0.089	−0.091	−0.079
				(0.29)	(1.12)	(1.15)	(0.99)
Academic[b]				0.288	0.190	0.187	0.203
				(3.20)*	(2.05)**	(2.02)**	(2.19)**
Government[c]				−0.232	−0.280	−0.285	−0.282
				(2.61)*	(3.09)*	(3.14)*	(3.07)*
Ambulatory				−0.124	−0.223	−0.218	−0.206
Center				(0.85)	(1.52)	(1.48)	(1.39)
For profit clinic				−0.075	−0.234	−0.239	−0.235
				(0.27)	(0.84)	(0.86)	(0.83)

(*continued*)

Table II.
Probit equations on board certification

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Community health				−0.395	−0.484	−0.475	−0.480
				(2.28)**	(2.73)*	(2.67)*	(2.70)*
Long-term care				−0.083	−0.108	−0.093	−0.043
				(0.13)	(0.16)	(0.14)	(0.06)
Other practice				−0.232	−0.287	−0.286	−0.270
				(0.85)	(1.05)	(1.04)	(0.98)
Own part or all of practice				0.336	0.228	0.230	0.206
				(1.26)	(0.84)	(0.85)	(0.76)
Hours per week worked					0.003	0.003	0.003
					(2.26)**	(2.29)**	(2.17)**
Weeks worked					−0.034	−0.034	−0.033
					(4.53)*	(4.49)*	(4.37)*
Experience					0.136	0.136	0.136
					(14.21)*	(14.17)*	(13.81)*
Parents' income class lower						−0.028	−0.041
						(0.24)	(0.36)
Parents' income class lower middle						0.172	0.163
						(1.63)	(1.54)
Parents' income class middle						0.139	0.134
						(1.37)	(1.31)
Parents' income class upper middle						0.080	0.073
						(0.77)	(0.70)
AMA Member							0.086
							(2.02)**
Malpractice claim							0.016
							(0.29)
Midwest							−0.026
							(0.42)
South							−0.028
							(0.52)
West							0.122
							(1.94)
Constant	0.997	0.947	1.145	1.122	1.852	1.723	1.657
	(24.25)*	(12.03)*	(12.17)*	(10.28)*	(4.87)*	(4.38)*	(4.18)*
Chi-square	201.98	232.11	411.57	457.97	695.16	704.79	715.70
Obs	5,685	5,685	5,685	5,685	5,685	5,685	5,685

Notes: [a] "Hospital" includes those practicing in hospitals or hospital clinics; [b] "Academic" includes those practicing in medical school or university settings; [c]"Government" includes those practicing in local, state or federal government facilities; * significant at 1 percent; ** significant at 5 percent; absolute value of *z* statistics in parentheses

Table II.

Wilensky and Rossiter (1983) find that board certification confers an increase of $13,000 in 1977, holding all else constant. Hampton and Heywood (1993) find that board certified males receive 12 percent more than their non-board certified counterparts. Within our sample, we find that board certified physicians receive 7 percent more in earnings. These differences may be attributable to the greater number of controls included in the later studies, implying that much of the returns to

certification in the earlier studies may be returns to other characteristics such as practice setting.

However, when those who are more likely to choose to become board certified are examined separate from those who are less likely to become certified, an interesting pattern is observed. Consistent with the tenet of the human capital theory, those who stand to gain the most in their markets through certification are more likely to become certified and vice versa. Physicians create a certain combination of quality and price to attract those patients who prefer their combination (Boardman *et al.*, 1983).

The market for physician services largely follows that of monopolistic competition (McCarthy, 1985). Physicians face competition but do have a certain degree of market power making the demand curve for their services slope downward. Consistent with economic theory, monopolistic competitors, when faced with high degrees of competition, seek to differentiate their product in an attempt to lower the elasticity of demand for their product and thus increase their market power and total revenues. This logic lends itself to the conclusion that those physicians who believe that they face high degrees of competition are more likely to become board certified in an attempt to differentiate their service and increase their market power and total revenues.

Competitive environment

In order to verify this assertion, physicians in the sample were divided into sub-samples according to their perception of competition in the market in which they practice. Because physicians may not be entirely aware of the economic definition of competition, the AMA survey clarifies "…by competition, we mean pressure to undertake various activities to attract and retain patients". The specific question used in this study is "Do you feel that in the community in which you practice there are too many, too few, or about the right number of physicians delivering the kinds of services you provide?"

Log income equations are then estimated to examine the financial impact of board certification consistent with the market characterized by the perceived competition[2]. Physicians with more specialty training typically work more hours and therefore hours and weeks worked are included in this specification so as to not overstate incremental earnings. The results of these specifications appear in Table III. As anticipated, those physicians who have the perception that too many physicians provide the kinds of services they do (proxy for high degree of competition) receive 15 percent increase to their income for becoming board certified, holding all else constant (Table III column 1). This may also be interpreted as those who choose not to become board certified in competitive markets are penalized in earnings. Also apparent from the results in Table III column 1, those who feel there are too few like physicians in their market receive no significant increase in earnings, or, are not penalized for their decision not to certify.

Practice setting

A similar investigation is then repeated by grouping physicians in practice settings according to their proclivity to become board certified. Physicians who are government employees and those employed by community health centers are significantly less likely to become board certified than their counterparts who are employed by an academic institution or a physician practice (control group in probit). Log income

	(1) Competitive status	(2) Practice setting	(3) White	(4) Non-white
Board certified	0.054	0.043	0.012	0.120
	(1.45)	(1.33)	(0.29)	(3.46)*
Too many docs	−0.139	–	–	–
	(2.33)**			
Board X competitive	0.152	–	–	–
	(2.28)**			
Too few docs	−0.009	–	–	–
	(0.16)			
Board X not competitive	−0.093	–	–	–
	(1.51)			
Academic	–	−0.182	–	–
		(1.11)		
Physician practice	–	−0.027	–	–
		(0.17)		
Board X academic X physician practice	–	0.121	–	–
		(1.80)		
Government	–	−0.178	–	–
		(1.08)		
Community health	–	0.155		
		(0.84)		
Board X community health X government	–	−0.026	–	–
		(0.31)		
White	–	–	−0.066	–
			(1.41)	
Board X White	–	–	0.094	–
			(1.75)	
Non-white	–	–	–	0.092
				(2.04)**
Board X non-white	–	–	–	−0.132
				(2.54)**
Log hours	0.238	0.228	0.232	0.233
	(8.30)*	(7.98)*	(8.11)*	(8.12)*
Log weeks worked	−0.198	−0.196	−0.188	−0.184
	(1.18)	(1.16)	(1.11)	(1.10)
Experience	0.116	0.116	0.114	0.114
	(4.35)*	(4.35)*	(4.27)*	(4.27)*
Experience squared	−0.006	−0.006	−0.006	−0.006
	(2.60)*	(2.59)*	(2.52)**	(2.52)**
Child under six years old in HH	−0.051	−0.051	−0.049	−0.049
	(1.62)	(1.64)	(1.56)	(1.56)
Married	0.026	0.026	0.030	0.030
	(0.88)	(0.89)	(1.04)	(1.03)
Male	0.220	0.225	0.226	0.225
	(8.34)*	(8.55)*	(8.60)*	(8.57)*
Black	−0.034	−0.034	–	–
	(0.95)	(0.96)		

Table III.
Log income equations

(*continued*)

	(1) Competitive status	(2) Practice setting	(3) White	(4) Non-white
Hispanic	−0.031	−0.031	–	–
	(0.90)	(0.91)		
Other non-white race	0.039	0.041	–	–
	(0.84)	(0.87)		
Specialty				
General internal medicine	0.004	0.018	0.015	0.014
	(0.14)	(0.57)	(0.47)	(0.44)
Special internal medicine	0.151	0.171	0.176	0.176
	(2.13)**	(2.42)**	(2.49)**	(2.48)**
General surgery	0.237	0.263	0.259	0.258
	(4.53)*	(5.07)*	(4.99)*	(4.98)*
Special surgery	0.497	0.519	0.516	0.516
	(11.72)*	(12.52)*	(12.44)*	(12.45)*
Pediatrics	−0.084	−0.075	−0.080	−0.080
	(2.11)**	(1.89)	(2.00)**	(2.01)**
OBGYN	0.423	0.442	0.433	0.434
	(8.60)*	(9.01)*	(8.86)*	(8.87)*
Radiology	0.631	0.657	0.656	0.656
	(11.99)*	(12.61)*	(12.60)*	(12.60)*
Psychiatry	0.045	0.060	0.053	0.053
	(0.86)	(1.16)	(1.02)	(1.02)
Anesthesiology	0.560	0.583	0.584	0.583
	(11.04)*	(11.58)*	(11.62)*	(11.61)*
Pathology	0.266	0.301	0.293	0.293
	(4.03)*	(4.59)*	(4.47)*	(4.46)*
Other specialty	0.281	0.299	0.323	0.328
	(1.85)	(1.97)**	(2.13)**	(2.16)**
Own all or part of practice	0.117	0.120	0.120	0.125
	(0.78)	(0.80)	(0.79)	(0.83)
Malpractice claim	0.076	0.075	0.074	0.075
	(2.73)*	(2.70)*	(2.67)*	(2.69)*
AMA member	0.100	0.102	0.101	0.100
	(4.47)*	(4.53)*	(4.49)*	(4.47)*
Practice settings				
HMO	0.064	0.135	0.064	0.064
	(1.06)	(0.86)	(1.06)	(1.06)
Hospital	0.077	0.136	0.065	0.064
	(1.75)	(0.89)	(1.49)	(1.46)
Hospital clinic	−0.102	−0.044	−0.112	−0.113
	(1.34)	(0.27)	(1.47)	(1.48)
Ambulatory care	0.025	0.079	0.009	0.007
	(0.31)	(0.48)	(0.11)	(0.09)
Medical school	−0.162	–	−0.165	−0.166
	(3.08)*		(3.14)*	(3.15)*
University or College	−0.107	–	−0.116	−0.117
	(1.57)		(1.70)	(1.72)
Local Government	−0.008	–	−0.048	−0.049
	(0.07)		(0.44)	(0.45)

(*continued*)

Table III.

	(1) Competitive status	(2) Practice setting	(3) White	(4) Non-white
State Government	−0.252	–	−0.268	−0.266
	(2.27)**		(2.41)**	(2.40)**
Federal Government	−0.296	–	−0.309	−0.310
	(5.22)*		(5.48)*	(5.50)*
For Profit Clinic	−0.063	0.000	−0.074	−0.077
	(0.42)	(.)	(0.48)	(0.50)
Community health	0.090	–	0.064	0.060
	(0.88)		(0.63)	(0.58)
Long-term care	0.030	0.083	0.017	0.019
	(0.08)	(0.22)	(0.05)	(0.05)
Other practice setting	0.140	0.206	0.135	0.129
	(0.92)	(0.98)	(0.88)	(0.84)
Midwest	−0.006	−0.006	−0.005	−0.006
	(0.18)	(0.20)	(0.17)	(0.18)
South	−0.029	−0.027	−0.030	−0.030
	(1.00)	(0.96)	(1.06)	(1.04)
West	−0.124	−0.121	−0.121	−0.121
	(3.80)*	(3.72)*	(3.72)*	(3.72)*
Prior job	−0.071	−0.073	−0.074	−0.074
	(3.24)*	(3.30)*	(3.38)*	(3.38)*
Parental income[a]	0.016	0.016	0.020	0.020
	(1.46)	(1.46)	(1.88)	(1.91)
Constant	3.877	3.810	3.832	3.741
	(5.88)*	(5.65)*	(5.81)*	(5.67)*
Observations	5,685	5,685	5,685	5,685
R-squared	0.24	0.24	0.24	0.24

Table III.

Notes: [a]Ordinal measure, 1 = low to 5 = high; * significant at 1 percent; ** significant at 5 percent; absolute value of *t* statistics in parentheses

equations are estimated with interactions for academic and physician practice with board certification as well as community health and government with board certification. As shown in Table III column 2, the returns to certification differ by practice setting. Consistent with the human capital theory, government and community health employees received nothing remotely significant in return for certification while physician practice employees and those working for academic institutions received a 12 percent income increase for certification, although only significant at the 10 percent level.

It seems logical to allow for this separate investigation of these markets on the grounds that the physicians in these markets do not compete for the same patients. Patients who seek physicians in community health centers are often forced to do so based on their socioeconomic status. Thus community health physicians compete with other community health physicians in that area but do not necessarily compete with physician practice employees. Similarly, patients who seek government physicians are often bound by contract (military) or compelled through other means. These results indicate that there is less competition in these practice settings and, indeed, the data

shows a strong positive correlation between physicians in these practice settings and the perception of little competition. The correlation coefficient between community health and government practice setting and perception that too few physicians provide the same services is 0.143.

Conversely, physicians who are physician practice employees or employed by academic institutions may feel competition from physicians in other practice settings. The increased competition in the product (service) market may lead to increased competition in the labor market. This could explain the increased tendency of physicians in these practice settings to become board certified. When labor markets are tight, higher qualifications are imposed on applicants for employment. Of course, physicians employed by academic institutions may also have an added incentive of credibility for certification.

Race

The dramatic difference in tendency to become board certified between white and minority physicians can be explained in terms of differing competition levels if substantial racial matching exists. Several surveys of medical graduates indicate that minority physicians treat a much higher percentage of minority patients than their white counterparts (Cantor *et al.*, 1996; Komaromy *et al.*, 1996; Penn *et al.*, 1986; Cohen *et al.*, 1990; Lloyd and Johnson, 1982). These data in the sample appear to confirm this. 46 percent of black physicians' patients are black while only 17 percent of white physicians' and Hispanic physicians' patients are black. This makes an argument in favor of guaranteed markets for minority physicians, possibly reducing competition and the need for differentiation in the form of board certification. Further evidence of guaranteed markets is provided when considering the percentage of poorer patients a physician treats. Fully 42 percent of black physicians' patients are considered poor while only 28 percent of white physicians' patients are considered poor, with Hispanic physicians falling in between with 35 percent of their patients being considered poor. When the white and non-white physicians are examined separately under this premise, the pattern of returns holds true. The results of these specifications appear in Table III, columns 3 and 4. Minority physicians, who are less likely to certify, receive a 13 percent decrease in earnings for certification while whites receive a 9 percent increase in their earnings from certification.

Recently, a different approach suggested that after controlling for variables including physician specialty, practice setting and location, racial matching occurred on a smaller scale and in some cases was not significant (Stinson and Thurston, 2002). This result appears at odds with our percentages of minority physicians treating poorer minority patients. This compelled an investigation that concluded that racial matching was not significant within our sample. Including the percentage of minority patients a physician treats and the percentage of poor patients that a physician treats reduces the probability of obtaining board certification by less than 1 percent, holding all else constant. Conversely, including an indicator for the percentage black and the percentage poor where the indicator takes the value of one if the physician reports that over 50 percent of their patients are black or poor reduces the likelihood of certification by 4 percent for those treating poorer patients. Although there appears to be some support for the racial matching and the premise of guaranteed markets, the contention that minority physicians face less competition may not hold. Therefore another

extension of the human capital theory must be proposed to explain the difference in proclivity to become board certified by race.

The human capital theory predicts that if discrimination is perceived, less investment in human capital will seem rational in the face of an expected lower rate of return. Indeed, recent research has confirmed that race negatively affects the benefits of higher quality resumes (Bertrand and Mullainathan, 2003). Perceived discrimination is investigated within this sample by looking at responses to a question in this survey. The question "Thinking now about your current and past practice arrangements, do you feel that your income was limited a great deal, somewhat, very little or not at all because of your race, ethnicity or gender". Minority physicians reported believing that their income was limited in some way because of race and/or ethnicity with 22.6 percent frequency while white physicians reported this perception with a 1.6 percent frequency.

The perception of discrimination appears to play a major factor in the discrepancy between likelihoods to certify between races. In the absence of this perception, when the return to investment is more certain and substantial, there exists a great deal of incentive to invest in certification. Statistical inference from this sample must conclude that the total difference in board certification is most likely a combination of the perception of discrimination as well as lower competition resulting from some small level of racial matching and guaranteed markets.

Costs of board certification

Results from Table II indicate that physicians in certain specialties (surgery, 9.1 percent, anesthesiology, 17.4 percent, internal medicine, 5.2 percent, OBGYN, 26.3 percent, psychiatry, 20.4 percent, and other specialty, 12.7 percent) are less likely to become certified than a general and family practitioner. Physician specialties are not limited to one competitive environment and thus the argument of differentiation to attract patients does not apply. Attempts to isolate incremental earnings associated with board certification within specialties were unsuccessful because specialty and competition are not linked. A physician's competitive environment is determined more by location and practice setting than by specialty choice. Therefore, the incremental earnings argument is insufficient to explain the pattern observed. Consequently, we turn our attention to the costs associated with certification.

Costs associated with any human capital endeavor are both explicit and implicit in nature. In this case, explicit costs include seminar fees, texts as well as fees for application and examination. Requirements for instruction vary according to the nature of the specialty. It is safe to assume that board certification for specialties such as surgery, obstetrics/gynecology and anesthesiology would require more instruction than general and family practice specialty. These requirement differences can cause explicit costs to be greater as the specialty becomes more rigorous.

Investigation of the examination fees and overall requirements for certification helped to explain the difference in proclivity to become certified by specialty. Not surprisingly, the American Board of Family Practice charges substantially less for examination fees than does any other specialty board examined. Our investigation showed an examination fee of $760 for family practice while the examination fees for others ranged from $1300 for surgery to $2450 for obstetrics and gynecology. In addition, family practice applicants for certification are only required to take a written

exam while all others investigated require both written and oral examinations. The additional requirement of an oral exam may serve to make those applicants less likely to apply for certification. As explicit costs increase, the likelihood of investing in board certification training declines.

Implicit costs play a much larger role in the tendency to invest in board certification. Because the price of non-labor market activity is the market wage, those trained in highly specialized areas of medicine are less likely to invest in board certification. Board certification is not necessary to practice medicine so those who are trained in a specialty with high earning potential are less likely to incur the increased implicit costs associated with non-labor market activity. This is due to the substitution effect dominating the income effect whereby the physician substitutes away from the more expensive non-labor market activity.

Selection correction

One critical issue common to this type of analysis is the possibility that the earnings returns attributed to board certification are a function of sorting across unmeasured variables correlated with productivity. In other words, more productive physicians may receive higher pay not due to board certified but because of their higher productivity. If this is the case, a portion of the incremental returns to board certification shown in the previous estimations may be mistakenly attributed to board certification, but in fact may be more likely the result of higher productivity physicians being more likely to become board certified due to the lower implicit costs of obtaining certification. Therefore, if the decision to certify is non-random, this will result in biased estimates. Theoretically, the decision to certify is dependent on whether the expected return is greater than the explicit and implicit costs associated with certification which will be unique for each individual, depending on each individual's characteristics. Hence, physicians who perceive low returns to certification due to lower productivity, implying higher implicit costs to certification, would be unlikely to certify and vice versa. In order to control for sample selection bias, we employ a sample selection model of Heckman (1979).

In order to control for this potential selectivity bias, we estimate sample selection corrected log income regressions for the estimations presented in Table III. These estimations roughly follow the pattern displayed in Table III and are therefore excluded but are available from the authors on request. As expected, controlling for sample selection and interacting certification with potentially endogenous covariates alters our results. Although the certification coefficient falls to insignificance, the familiar pattern persists. Physicians who feel that there are too many physicians in their market, our proxy for a competitive market, receive a positive return to certification and physicians who feel that there are too few physicians in their market receive no significant income gain to certification. Furthermore, those practicing in academic and physician practice settings are found to receive high returns to certification while those in community health and government settings do not.

Ideally, we would like to implement a fully interacted model in which board status interacts with the key variables and which also corrects for sample selection by board status. Unfortunately, doing so requires a fair amount of calculation as board status is both the variable used to select the different estimations and the source of potential interaction. One approach is to use the earnings estimates selected by sample selection,

and so fully interacted, to generate different predicted wages to calculate the differences in earnings between the groups of interest. This is done by using the earnings estimates selected by sample selection, and so fully interacted, to generate different predicted earnings among the sub-groups of interest. We then estimate two earnings equations, one for those who are certified and another for those who are not certified. We then take the mean characteristics and predict the earnings within each sector (i.e. certified and competitive, not certified and competitive, certified and not competitive, and not certified and not competitive, etc...). Doing so allows us to compare the interaction effects where we can consider differences associated with certification when the market is competitive or not competitive. Following this procedure, we find that those who certify and operate in a more competitive markets gain more in earnings from certification than those in less competitive markets (4.55 versus 4.26). Also, those who certify in academic and physician practice settings receive a larger boost in earnings than those who certify in government or community health settings (4.30 versus 3.69). Furthermore, white physicians who certify receive a larger increase in earnings than non-whites (4.59 versus. 4.12).

Another approach is to split the sample between certified and non-certified to determine how different factors of interest influence the earnings of certified and non-certified physicians. The results of these estimations, along with the sample selection corrected estimates, are presented in Table IV. Employing the sample selection method alters the determinants of income because we are accounting for unmeasured differences between those who certify and those who do not certify. Also the inclusion of additional observations likely increases the variation in the data resulting in more robust estimations than we likely obtained when only estimating within the various groupings. Comparing columns 2 and 4 in Table IV shows that after controlling for sample selection, board certified black and Hispanic physicians receive substantially lower income (over 50 percent less for blacks and 45 percent less for Hispanics) than their white counterparts while non-board certified black and Hispanic physicians' income is not significantly different than their white counterparts. This differs from the findings of Hampton and Heywood (1994) who found larger returns to certification among minority male physicians than white males. Additionally, the returns to specialty choice are typically greater for board certified physicians than they are for non-board certified physicians, except for OBGYN and anesthesiology. For example, board certified physicians specializing in special internal medicine receive 60 percent more than their non-board certified counterparts. Also, physicians practicing in a governmental setting, especially state and federal governments, receive 5 percent less income if board certified than their non-certified counterparts. Therefore, consistent with our prior results, board certified physicians who are non-white, practice in community health, government, and academia receive lower income than their non-board certified counterparts and consequently should be much less likely to certify. Accordingly, the decision to certify represents a rational choice. Those who receive larger returns to certification are more likely to certify while those who stand to gain little from certification are less likely.

Using the sample selection corrected estimations reported above, we predict the log income for each group, certified and non-certified. The predicted log income measures the return to certification among those who obtain certification across the entire sample and the predicted log income among those who do not become certified across the

	(1) Board certified	(2) Board certified w/ sample selection	(3) Non-board certified	(4) Non-board certified w/ sample selection
Male	0.214	0.181	0.252	0.228
	(7.17)*	(3.61)*	(4.40)*	(3.64)*
Black	−0.095	−0.437	0.083	−0.210
	(2.21)**	(3.98)*	(1.27)	(1.29)
Hispanic	−0.030	−0.368	−0.007	−0.297
	(0.77)	(3.40)*	(0.10)	(1.83)
Other non-white race	0.001	−0.325	0.132	−0.160
	(0.01)	(2.82)**	(1.41)	(0.91)
Log hours	0.215	0.223	0.308	0.310
	(6.64)*	(4.82)*	(4.94)*	(5.05)*
Log weeks worked	−0.324	−0.292	0.216	0.227
	(1.66)	(1.05)	(0.64)	(0.69)
Experience	0.152	0.248	0.027	0.087
	(4.90)*	(4.86)*	(0.49)	(1.39)
Experience squared	−0.009	−0.011	0.001	0.002
	(3.36)*	(2.92)*	(0.24)	(0.46)
Child under six years old in HH	−0.066	−0.029	0.016	0.050
	(1.92)	(0.49)	(0.22)	(0.63)
Married	0.003	0.129	0.087	0.192
	(0.08)	(1.97)**	(1.50)	(2.32)**
Specialty				
General internal medicine	0.021	−0.030	−0.011	−0.049
	(0.59)	(0.50)	(0.14)	(0.60)
Special internal medicine	0.233	0.468	−0.218	−0.056
	(3.08)*	(3.23)*	(1.07)	(0.22)
General Surgery	0.338	0.227	−0.008	−0.101
	(5.76)*	(2.22)**	(0.07)	(0.78)
Special surgery	0.551	0.502	0.390	0.352
	(11.96)*	(6.40)*	(3.97)*	(3.33)*
Pediatrics	−0.062	0.001	−0.138	−0.063
	(1.42)	(0.01)	(1.38)	(0.56)
OBGYN	0.410	0.048	0.435	0.155
	(6.81)*	(0.35)	(4.73)*	(0.89)
Radiology	0.678	0.807	0.479	0.666
	(12.22)*	(7.96)*	(3.04)*	(3.55)*
Psychiatry	0.034	−0.269	0.051	−0.184
	(0.54)	(2.08)**	(0.52)	(1.15)
Anesthesiology	0.574	0.407	−0.100	0.412
	(9.91)*	(3.88)*	(0.43)	(3.07)*
Pathology	0.336	0.535	−0.100	0.190
	(4.89)*	(4.08)*	(0.43)	(0.68)
Other specialty	0.554	0.380	−0.236	−0.364
	(3.03)*	(1.59)	(0.86)	(1.32)
Own all or part of practice	0.290	0.266	−0.253	−0.271
	(1.63)	(1.02)	(0.89)	(0.96)
Malpractice claim	0.074	0.086	0.076	0.090
	(2.40)**	(1.65)	(1.15)	(1.28)
AMA Member	0.103	0.098	0.081	0.076
	(4.07)*	(2.73)*	(1.63)	(1.55)

(*continued*)

Table IV.
Log income estimations by board certification status

	(1) Board certified	(2) Board certified w/ sample selection	(3) Non-board certified	(4) Non-board certified w/ sample selection
Practice settings				
HMO	0.066	0.150	0.068	0.145
	(0.98)	(1.31)	(0.48)	(0.92)
Hospital	0.022	−0.026	0.243	0.193
	(0.44)	(0.32)	(2.50)**	(1.81)
Hospital clinic	−0.118	−0.151	−0.082	−0.112
	(1.39)	(1.18)	(0.49)	(0.65)
Ambulatory care	0.078	−0.018	−0.122	−0.223
	(0.83)	(0.11)	(0.74)	(1.20)
Medical school	−0.160	−0.070	−0.208	−0.096
	(2.77)*	(0.71)	(1.59)	(0.65)
University or College	−0.154	−0.057	0.066	0.183
	(2.09)**	(0.47)	(0.36)	(0.96)
Local Government	−0.015	−0.157	−0.086	−0.247
	(0.12)	(0.83)	(0.42)	(1.11)
State Government	−0.360	−0.515	−0.046	−0.175
	(2.64)*	(2.63)*	(0.24)	(0.84)
Federal Government	−0.310	−0.475	−0.263	−0.391
	(4.69)*	(4.19)*	(2.33)**	(2.87)*
For profit clinic	−0.073	−0.174	−0.074	−0.174
	(0.42)	(0.59)	(0.24)	(0.50)
Community health	−0.107	−0.384	0.370	0.172
	(0.83)	(1.75)	(2.17)**	(0.80)
Long-term care	−0.008	0.030	0.195	0.146
	(0.02)	(0.05)	(0.24)	(0.17)
Other practice	−0.058	−0.059	0.595	0.591
	(0.32)	(0.22)	(2.04)**	(2.07)**
Midwest	−0.015	−0.009	0.045	0.047
	(0.44)	(0.19)	(0.62)	(0.67)
South	−0.038	−0.035	0.030	0.028
	(1.19)	(0.75)	(0.48)	(0.45)
West	−0.132	−0.128	−0.084	−0.090
	(3.64)*	(2.47)*	(1.12)	(1.21)
Prior job	−0.090	−0.083	0.003	0.006
	(3.67)*	(2.36)*	(0.05)	(0.13)
Parental income[a]	0.016	0.015	0.014	0.014
	(1.28)	(0.83)	(0.60)	(0.61)
Constant	4.448	3.396	1.938	2.568
	(5.83)*	(3.04)*	(1.45)	(1.90)
Inverse mills ratio	–	1.415	–	−0.701
		(3.82)*		(1.99)**
R-squared	0.25	–	0.24	–
Chi-squared	–	924.88	–	727.13
Observations	4,503	5,685	1,182	5,685

Table IV.

Notes: [a] Ordinal measure, 1 = low to 5 = high; * significant at 1 percent; ** significant at 5 percent; absolute value of *t*-statistics in parentheses

entire sample. We then include the difference of the predicted selection corrected log incomes between those who are certified and those who are non-certified in the original probit equation of Table II, column 7. This approach has been utilized by many prior researchers including Hampton and Heywood (1993), Belman and Heywood (1989) and Lee (1978). According to Lee (1978), the resulting coefficient estimates are known to be unbiased. As shown in Table V, column 2, the coefficient of the predicted incremental earnings associated with certification is extremely large and significant implying that expected returns to certification and the likelihood to become board certified have a strong direct relation. The probability of certification increases by 17 percent for every 1 percent increase in expected income gain. Consequently, the returns to certification are attributed to the market power that board certification provides and not to the higher productivity among those who choose to become certified.

Comparing columns 1 and 2 in Table V shows that including the expected return to certification significantly alters the determinants of certification. For example, from Table V, column 1, blacks were 20 percent less likely to become certified controlling for specialty, practice setting, and other demographic characteristics[3]. After including the estimated return to certification, Table V, column 2, blacks are almost half as less likely to obtain certification (11 percent). Therefore, blacks may be less likely to certify because the expected returns to certification are perceived to be lower for blacks and thus are making a rational decision not to become certified based on the lower expected returns. Therefore, this indicates that what looks like a racial difference is really a difference in the reward that certification brings and that the reward differs by race. A similar pattern exists for Hispanics and other non-white race as well. Confirming prior results, those in certain specialties and practice settings are still less likely to certify.

Conclusion

Physicians' decision to become board certified in their respective specialties rigidly follows a pattern consistent with the human capital theory. Those who perceive their market to be competitive are more likely to choose to become board certified in order to differentiate their service and increase their market share. This is also apparent by practice setting whereby those who practice in community health centers or in government settings are less likely to choose to become board certified because they operate in settings where the degree of competition is low. Incremental earnings associated with board certification reflect that those who are more likely to become certified are rewarded for their decision. In addition, those who are less likely to become certified are not significantly rewarded in incremental earnings should they decide to become certified.

Minority physicians are significantly less likely to become board certified than their white counterparts largely because their reward to board certification among minorities is small in comparison to whites. This difference is largely attributed to uncertain returns to investment in board certification for minorities, making their likelihood of undertaking the investment decline significantly. A possible explanation for this is that racial matching occurs where minority physicians have a guaranteed market implying little or no competition and therefore little incentive to invest in board certification even though the sample used in this study does not fully support this theory.

Variable	(1) Coefficient	(2) Coefficient
Predicted income gain to Board Certification	–	0.647
		(3.39)*
Male	− 0.059	− 0.028
	(1.19)	(0.55)
Black	− 0.622	− 0.482
	(10.15)*	(6.52)*
Hispanic	− 0.511	− 0.474
	(8.50)*	(7.77)*
Other non-white race	− 0.490	− 0.393
	(5.88)*	(4.47)*
Own part or all of practice	0.206	− 0.160
	(0.76)	(0.55)
Experience	0.136	0.131
	(13.81)*	(13.15)*
Children under six years old in household	0.075	0.118
	(1.24)	(1.89)
Married	0.212	0.250
	(4.02)*	(4.62)*
Specialty		
Internal medicine (General)	− 0.236	− 0.255
	(3.42)*	(3.69)*
Internal medicine (Special)	0.314	0.047
	(2.04)**	(0.27)
Surgery (General)	− 0.383	− 0.594
	(3.76)*	(4.96)*
Surgery (Special)	− 0.272	− 0.375
	(3.14)*	(4.08)*
Pediatrics	− 0.005	− 0.054
	(0.06)	(0.63)
OBGYN	− 0.787	− 0.724
	(8.51)*	(7.67)*
Radiology	0.098	0.005
	(0.81)	(0.04)
Psychiatry	− 0.630	− 0.574
	(6.49)*	(5.83)*
Anesthesiology	− 0.544	− 0.535
	(5.54)*	(5.43)*
Pathology	0.342	0.108
	(2.17)**	(0.63)
Other specialty	− 0.416	− 0.456
	(4.61)*	(5.01)*
Practice setting		
Hospital[a]	− 0.079	0.038
	(0.99)	(0.44)
Academic[b]	0.203	0.235
	(2.19)**	(2.51)**
Government[c]	− 0.282	− 0.237
	(3.07)*	(2.56)**
HMO	0.144	0.143
	(1.21)	(1.21)

(*continued*)

Table V.
Probit equations on Board Certification

Variable	(1) Coefficient	(2) Coefficient
Ambulatory center	−0.206	−0.349
	(1.39)	(2.26)**
For profit clinic	−0.235	−0.278
	(0.83)	(0.99)
Community health	−0.480	−0.145
	(2.70)*	(0.71)
Long-term care	−0.043	0.107
	(0.06)	(0.16)
Other practice	−0.270	0.154
	(0.98)	(0.51)
Malpractice claim	0.016	0.020
	(0.29)	(0.36)
AMA member	0.086	0.074
	(2.02)**	(1.73)
Hours per week worked	0.003	0.003
	(2.17)**	(2.84)*
Weeks worked	−0.033	−0.025
	(4.37)*	(3.13)*
Parents' income class lower	−0.041	−0.034
	(0.36)	(0.29)
Parents' income class lower middle	0.163	0.167
	(1.54)	(1.58)
Parents' income class middle	0.134	0.139
	(1.31)	(1.36)
Parents' income class upper middle	0.073	0.072
	(0.70)	(0.69)
Midwest	−0.026	0.012
	(0.42)	(0.20)
South	−0.028	0.016
	(0.50)	(0.28)
West	0.122	0.154
	(1.934)	(2.42)**
Constant	1.657	2.019
	(4.18)*	(4.91)*
Chi-square	715.98	727.31
Observations	5,685	5,685

Notes: [a] "Hospital" includes those practicing in hospitals or hospital clinics; [b] "Academic" includes those practicing in medical school or university settings; [c] "Government" includes those practicing in local, state or federal government facilities; * significant at 1 percent; ** significant at 5 percent; absolute value of *z*-statistics in parentheses

Table V.

Differences in certification by specialty are explained by explicit and implicit costs. Those who face higher costs associated with certification are less likely to become certified. In addition, those who practice in specialties with higher than average earning potential are less likely to invest as they substitute away from the relatively more expensive non-labor market activity.

Overall, the decisions made by physicians to certify follow the overall tenet of the human capital theory. Those who are more likely to invest in certification are those who stand to gain the most in earnings. In addition, those who are more likely to invest

are those who incur less explicit and implicit costs. These decisions must be made with rational self-interest in mind because these physicians are highly educated and fully capable of completing this instruction. The physician must decide, given their circumstances, if this instruction is worthwhile. Consequently, nonwhites are less likely to certify because the expected returns to board certification are lower than their white counterparts. Therefore, our findings help to explain the absence of minority board certified physicians within the USA.

Some caveats require mentioning. One is that the data used in this analysis apply only to young physicians in the USA. who completed their residency between 1986 and 1989 or participated in the 1987 Survey of Young Physicians and hence may not be reflective of current trends among physicians. Given that physicians may be likely to pursue certification early in their career, the fact that we are analyzing a cohort of relatively young physicians my not be too problematic. Furthermore, these results only pertain to a specific cohort and may not be reflective of the population at large. This is especially pertinent given the vast change health care markets have undergone over the past decade.

Further work on this subject should consider larger, more recent samples of physicians and, if possible, employ panel data methods to further control for unobserved heterogeneity. Additionally, further research must control for the proliferation of specialization within the medical community to see if the racial results concerning board certification are robust to the refinement of the type of specialty.

Notes

1. Data are available from ICPSR at: http://webapp.icpsr.umich.edu/cocoon/ICPSR-STUDY/06145.xml
2. Interacting certification status with differing groups of potentially endogenous variables failed to eliminate the patterns reported in Table III. The results of these estimations are available on request from the authors.
3. The marginal effects are calculated as:

$$m_{ij} = \frac{\partial F(X, \beta)}{\partial X_i \beta_i} \beta_{ij}$$

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