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Abstract

Average wages tend to increase with city size. Most explanations of this urban wage premium emphasize productivity spillovers. This paper proposes a consumption-side explanation. The claim is that the wide consumption variety found in large cities is more important to high-skill (hence high-income) workers than low-skill workers, and thus the higher wages found in large cities are due to the selection of high skill workers choosing to live there. A testable implication of my theory, distinguished from productivity-based theories, is that urban wage premiums may be negative for high-skill workers. This implication is confirmed by data on the medical profession. At the top skill level, there is substantial urban wage discount: doctors in large cities are paid 8 percent less than their peers in small cities.

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1 Introduction

There is a large literature on the connection between average pay and city size. Empirical work has documented that workers in large cities are paid substantially more than those in small cities, with differences on the order of 30 percent (e.g., Glaeser and Mare (2001), Rauch (1993)). Theoretical work has emphasized the importance of productivity spillovers in accounting for why workers in large cities may be more productive and thus earn higher wages (e.g., Lucas (1988), Henderson (1974)).

A second, perhaps even larger, literature emphasizes the connection between consumption variety and city size. Large cities have museums, professional sports teams, and French restaurants that small cities do not have. Extensive theoretical literature accounts for this wide consumption variety in cities through scale economies (e.g., Krugman (1991)). However, this literature on variety has not connected with the literature on urban wage premium. In fact, there is a tension here. Since rural areas have little product variety, we might even expect a compensating premium to be paid to workers in rural areas.

This paper presents a theory that links the substantial variety to be found in large cities with the higher pay of the workers who live there. The theory has two crucial ingredients. First, workers vary in skill and hence earning power. Second, preferences are such that product variety found in large cities is deemed to be an income elastic good. That is, convenient access to French restaurants is something that is relatively more important to a rich person than a poor person. The high wages found in large cities are due to high skill workers selecting to live there.

The theory also delivers new testable implications. The most striking implication is that the wage differential between large cities and small cities, for fixed skill, should be decreasing in skill. In fact, for high enough skill levels, the differential turns negative and workers in large cities are paid less than their small-city counterparts. Such workers, with great earning power and thus great

demand for urban amenities, need significant financial inducements to move to rural areas.

I examine this implication using data from the health care sector. I chose this sector because it is the best example of an industry for which it is absolutely necessary to employ extremely high-skill workers (doctors) in small cities. This is different from the legal industry, for example, where there is no need for patent attorneys in small cities. I find that high-skill health care workers in large cities are paid substantially less than their counterparts in small cities; doctors in large cities are paid 8 percent less than doctors in small cities. Moreover, across doctors, those in the highest paying specialties get the largest pay discounts; surgeons in large cities are paid 18 percent less than surgeons in small cities. Across the health care sector as a whole, the wage city premium sharply decreases as skill level rises. Nurses and physician assistants, for example, are paid more in large cities while doctors and dentists are paid less. The finding that doctors are paid less in large cities is particularly striking because I also find evidence that even among doctors the better ones tend to locate in large cities, in accordance with my theory. Large-city doctors are more likely to be high-skill specialists from top medical schools.

A second implication of the theory is that firms in large cities substitute relatively cheaper high-skill workers for relatively more expensive low-skill workers, as compared to firms in small cities. In the health care sector the ratio of doctors to nurses, for example, is higher in large cities. This ability sorting, a high proportion of the health care workforce being doctors in large cities, causes the average pay of health care workers to be substantially higher in larger cities. I find that this ability sorting effect accounts for at least 70 percent of the urban wage premium in the health care sector.

What turns out to be crucial for my theory is that expenditure shares on consumption variety relative to residential land increase with income, that is, that the demand for differentiated consumption goods is more income elastic than the demand for land. I am not aware of any pre-

vious empirical work that directly estimates these parameters, but there exists previous empirical work that indirectly substantiates this assumption. First, it is well-known among urban economists that the demand for residential land is income inelastic. For example, Glaeser, Kahn, and Rappaport (2000) estimate the income elasticity of land demand to be less than 0.4. Second, two pieces of evidence jointly suggest that the demand for consumption variety is income elastic. Bils and Klenow (2001) show that high-income people consume more high-quality goods. Berry and Waldfogel (2003) show that restaurant quality increases with city size.

The key results of this paper are structured as follows. Section 2 reviews related literatures. Section 3 presents the model and its theoretical implications. Section 4 provides empirical evidence from the health care sector as a whole. First, urban wage premiums are lower for high-skill occupations and are even negative at top skill levels. Second, high-skill occupations are more concentrated in large cities. Third, ability sorting accounts for 70 percent of the urban wage premium in the health care sector. Section 5 provides evidence from doctors only but differentiated by different specialties and quality. First, doctors in high-skill specialties have lower urban wage premiums than their counterparts in low-skill specialties, and are relatively more concentrated in large cities. Second, doctors from better medical schools are more likely to locate in large cities even with the same specialties. Section 6 discusses alternative explanations for the negative urban wage premiums of high-skill health care workers and considers other high-skill occupations outside the health care sector.

2 Related Literature

There are other papers in the empirical urban wage premium literature which have argued that ability sorting may play a role in accounting for the observed urban wage premium (e.g. Glaeser and Mare (2001), Combes, Duranton, and Gobillon (2004)). This paper differs from the literature

in two ways. First, I propose an explicit theoretical mechanism for why the selection takes place. Second, I account for the fact that the actual premium can be dramatically different for different skills. My key finding is that the size-wage relationship depends in an important way on skill, and may even be negative for high enough skills.

A closely related literature to urban wage premium literature is growth literature on human capital externalities. Lucas (1988) argues that human capital externalities may explain the differences in growth rates across countries, and empirical researchers have been trying to find evidence that otherwise identical workers are more productive in areas with a higher average education level (Rauch (1993), Acemoglu and Angrist (1999), Ciccone and Peri (2002), and Moretti (2004)). However, this paper shows that the self-selection issue is much more formidable than has been controlled for in the literature. For example, not only are there more doctors in large cities, but the large-city doctors also tend to be higher-skill specialty doctors from better medical schools. The ability sorting seems to occur at every level, and it would be very hard to control for all of them.

This paper is also related to the literature on the quality of life across geographic areas (Rosen (1979), Roback (1982), Blomquist, Berger, and Hoehn (1988), and Gyourko and Tracy (1991)). Roback (1982) shows how wages and rents are jointly determined by two equilibrium conditions – utility and profit equalization across areas for perfectly mobile workers and firms. This paper, in contrast, can focus only on the workers’ utility equalization condition by looking at an indispensable non-tradable good sector (the health care sector).

The role of cities as consumption centers started drawing attention recently. This “consumer city” literature emphasizes urban amenities as the centripetal force attracting workers into cities (e.g. Glaeser, Kolko, and Saiz (2000), Tabuchi and Yoshida (2000)). However, if cities are better places for living, workers should be paid more in rural areas and we should see urban wage *discount*, not premium. This paper reconciles the tension between consumer city literature and urban wage

premium by introducing different levels of skills and ability sorting.

3 The Theory

This section provides a partial equilibrium model of location decisions for the health care workers, and studies its implications for equilibrium wage and skill distribution across different-sized cities. The key element of the model is that the demand for differentiated local goods is more income elastic than the demand for residential land. This implies that high-skill workers prefer to live in large cities. As a result, high-skill workers are relatively lower paid and more concentrated in large cities.

3.1 The Model

There is a continuum of cities, and they are indexed by their population sizes $n \in N$ where $N \subset \mathbb{R}_+$ is an interval. A city of size n has an exogenously given consumption variety level $v(n)$ and rent (or land price) $r(n)$. I assume that larger cities have higher consumption variety levels and higher rents.¹

$$v'(n) > 0 \text{ and } r'(n) > 0.$$

Workers are heterogeneous in skills. I assume that workers with skill $\theta \in [\underline{\theta}, \bar{\theta}]$ have an outside option offering utility $\bar{u}(\theta)$, and $\bar{u}(\theta)$ is increasing in θ .

$$\bar{u}'(\theta) > 0.$$

Workers consume land h and a set of differentiated local goods $\{q(x) \mid x \in \{0, v\}\}$. The following

¹These assumptions can be easily endogenized in a bigger model. See Krugman (1991) and Duranton and Puga (2004) for examples.

utility function describes their preference.

$$\begin{aligned} & \left(\int_0^v q(x)^{\frac{1}{\mu}} dx \right)^\mu & \text{if } h \geq 1 \\ & -\infty & \text{if } h < 1 \end{aligned}$$

where $\mu > 1$ is the local good complementarity parameter. The condition $\mu > 1$ implies that workers care about the consumption variety level v . Note that the preference is non-homothetic such that workers demand one unit of land regardless of their incomes. This perfectly inelastic demand for land makes the demand for differentiated local goods income elastic.²

Workers first decide whether to take the outside option or not and which city to live in. Once in city n , ability θ workers get paid the wage $w(\theta, n)$, consume one unit of land paying the rent $r(n)$, and spend the rest of their income $w(\theta, n) - r(n)$ on the range $v(n)$ of diversified local goods. The local goods are assumed to have the same prices across all types and locations, and I set this price as numeraire.³ In summary, ability θ workers solve the following optimization problem.

$$\begin{aligned} & \max_n \left\{ \bar{u}(\theta), \tilde{U}(\theta, n) \right\} \text{ s.t.} \\ & \tilde{U}(\theta, n) = \max_{q(x)} \left(\int_0^{v(n)} q(x)^{\frac{1}{\mu}} dx \right)^\mu \text{ s.t. } \int_0^{v(n)} q(x) dx = w(\theta, n) - r(n). \end{aligned} \quad (1)$$

A city of population size n requires n units of medical service to be locally provided. Medical service production technology is the following standard CES production function.

$$\left(\int_{\underline{\theta}}^{\bar{\theta}} l(\theta, n)^{\frac{1}{\gamma}} d\theta \right)^\gamma$$

²It is only for simplicity that I assume the *perfect* income inelastic demand for land. All the results in this paper would hold with any income inelastic demand for land.

³This assumption can be endogenized by local good production technology of constant unit marginal cost. In addition, this assumption can be relaxed so that local good prices are different from city to city. In this case I need to introduce exchange rates between local goods in different cities.

where $l(\theta, n)$ is the measure of type θ workers employed in the medical service sector in city n , and $\gamma < 0$ is the input complementarity parameter. The CES technology requires all skill types for production, and this captures the characteristic of the health care sector that they need to have doctors even in small cities. In summary, medical service providers in city n solve the following profit maximization problem.

$$\max_{l(\theta, n)} p^m(n) \cdot \left(\int_{\underline{\theta}}^{\bar{\theta}} l(\theta, n)^{\frac{1}{\gamma}} d\theta \right)^\gamma - \int_{\underline{\theta}}^{\bar{\theta}} w(\theta, n) l(\theta, n) d\theta$$

where $p^m(n)$ is the unit price for medical service in city n .

3.2 Equilibrium

There are three conditions an equilibrium has to satisfy. First, workers maximize their utilities. Second, medical service providers in each city maximize their profit. Third, the medical service market in each city has to clear.

First, I characterize workers' utility maximization conditions. To begin, I calculate the indirect utility of skill θ workers living in city n . Since both the prices and the utility weights are equal across all types of local goods, workers consume the same quantity of local goods across all types. In other words, there is $q \in \mathbb{R}_+$ such that $q(x) = q$ for all $x \in [0, v(n)]$ solves the workers' optimization problem (1). Substituting q for $q(x)$ in the optimization problem (1), I obtain the following indirect utility function.

$$\tilde{U}(\theta, n) = v(n)^{\mu-1} (w(\theta, n) - r(n)). \quad (2)$$

Since workers can freely choose where to live and whether to take the outside option, the indirect

utilities across all cities have to be equal to the reservation utility $\bar{u}(\theta)$ offered by the outside option.

$$\tilde{U}(\theta, n) = \bar{u}(\theta) \text{ for all } n \in N. \quad (3)$$

Second, I characterize the profit maximization condition of the medical service provider in each city. Since the CES production technology used by medical service providers has a constant returns to scale (CRS) property, I can consider one aggregate medical service provider for each city. In addition, the aggregate medical service provider in each city employs constant share of skill types regardless of output levels due to the property of CRS technologies. The first order conditions for profit maximization imply the following share of skill types for production.

$$\frac{l(\theta_1, n)}{l(\theta_2, n)} = \left(\frac{w(\theta_1, n)}{w(\theta_2, n)} \right)^{\frac{\gamma}{1-\gamma}} \text{ for any } \theta_1, \theta_2 \in [\underline{\theta}, \bar{\theta}] \quad (4)$$

Third, the medical service market clearing condition is simple. The aggregate medical service provider in city n has to produce n units of medical service.

$$n = \left(\int_{\underline{\theta}}^{\bar{\theta}} l(\theta, n)^{\frac{1}{\gamma}} d\theta \right)^{\gamma} \quad (5)$$

An equilibrium of this model consists of the list $\{(w(\theta, n), l(\theta, n)) \mid \theta \in [\underline{\theta}, \bar{\theta}], n \in N\}$ satisfying conditions (2) to (5) for each city n . The wage schedules $w(\theta, n)$ are pinned down by the workers' utility maximization conditions (2) and (3). The geographic distribution of medical workers $l(\theta, n)$ is determined by conditions (4) and (5).

3.3 Implications

This section derives two implications from the model. The first implication is for equilibrium prices and the second implication is for equilibrium quantities.

First, I derive the price implication. Urban wage premiums, for fixed skills, are decreasing in skill and are negative for high enough skills. To begin, I define urban wage premium as how much percentage the wage increases when city size doubles. I later estimate this urban wage premium using data.

Definition 1 *The urban wage premium $\beta^w(\theta, n)$ for skill type θ at city size n is defined as the population size elasticity of the wage.*

$$\beta^w(\theta, n) = \frac{\partial \log w(\theta, n)}{\partial \log n}.$$

The wage schedule $w(\theta, n)$ is pinned down by equations (2) and (3).

$$w(\theta, n) = r(n) + \bar{u}(\theta) \cdot \frac{1}{v(n)^{\mu-1}}. \quad (6)$$

The wage schedule (6) shows that there are two types of wage compensations to ensure the same level of utility to workers of the same skill across different cities. One is the land price compensation $r(n)$ and the other is the consumption variety compensation $\bar{u}(\theta)/v(n)^{\mu-1}$. Note that the two compensations work in the opposite direction. As city size n rises, the land price compensation $r(n)$ increases while the consumption variety compensation $\bar{u}(\theta)/v(n)^{\mu-1}$ decreases. The land price compensation $r(n)$ is equal across different skill types of workers because all workers consume one unit of land regardless of their skills. On the other hand, the consumption variety compensation $\bar{u}(\theta)/v(n)^{\mu-1}$ is increasing in skill θ because the demand for local goods is income

elastic. Therefore, urban wage premiums are positive for low-skill workers for whom the land price compensation dominates the consumption variety compensation, and are negative for high-skill workers for whom the consumption variety compensation dominates the land price compensation.

Proposition 1 1) *The urban wage premium $\beta^w(\theta, n)$ for fixed skill θ at city n is decreasing in skill θ .*

$$\frac{\partial}{\partial \theta} \beta^w(\theta, n) < 0 \text{ for all } n \in N$$

2) *The urban wage premium $\beta^w(\theta, n)$ for skill θ at city n is negative if and only if*

$$\theta > u^{-1} \left(\frac{r'(n) v(n)^\mu}{(\mu - 1) v'(n)} \right).$$

Proof. The first result is obtained by differentiating $\beta^w(\theta, n)$ with respect to θ .

$$\frac{\partial \beta^w(\theta, n)}{\partial \theta} = \frac{\partial}{\partial \theta} \frac{\partial w(\theta, n)}{\partial n} \frac{n}{w(\theta, n)} = - \frac{nv(n)^\mu u'(\theta) (v(n)r'(n) + (\mu - 1)r(n)v'(n))}{(r(n)v(n)^\mu + u(\theta)v(n))^2} < 0.$$

The second result follows directly from wage equation (6). ■

Now I derive the quantity implication. High-skill workers are more concentrated in large cities as compared with low-skill workers. To begin, I define urban concentration rate as the percentage by which the number of workers increases when city size doubles. Later, I estimate the urban concentration rates using data.

Definition 2 *The urban concentration rate $\beta^q(\theta, n)$ for type θ at city size n is defined as the population size elasticity of the number of skill θ workers.*

$$\beta^q(\theta, n) = \frac{\partial \log l(\theta, n)}{\partial \log n}$$

The quantity implication follows straight from the price implication and medical service providers' first order conditions. The price implication in Proposition 1 implies that high-skill workers are relatively cheaper in large cities. Medical service providers in large cities substitute these relatively cheaper high-skill workers for relatively more expensive low-skill workers.

Proposition 2 *The urban concentration rate $\beta^q(\theta, n)$ at city n is increasing in skill θ .*

$$\frac{\partial}{\partial \theta} \beta^q(\theta, n) > 0 \text{ for all } n \in N$$

Proof. I obtain the equilibrium distribution of health care sector workers $l(\theta, n)$ from condition (4) and condition (5).

$$l(\theta, n) = n \cdot \frac{w(\theta, n)^{\frac{\gamma}{1-\gamma}}}{W(n)^\gamma}$$

where $W(n) = \int_{\underline{\theta}}^{\bar{\theta}} w(\theta, n)^{\frac{1}{1-\gamma}} d\theta$.

$$\frac{\partial}{\partial \theta} \beta^q(\theta, n) = \frac{\partial}{\partial \theta} \frac{\partial}{\partial \log n} \log \left(n \cdot \frac{w(\theta, n)^{\frac{\gamma}{1-\gamma}}}{W(n)^\gamma} \right) = \frac{\gamma}{1-\gamma} \frac{\partial \beta^w(\theta, n)}{\partial \theta} > 0.$$

The last inequality comes from Proposition 1. ■

4 The Health Care Sector as a Whole

This section presents empirical evidence using data on the health care sector as a whole. Subsection 1 confirms the price implication. Subsection 2 confirms the quantity implication. Subsection 3 shows that ability sorting can account for 70 percent of urban wage premium in the health care sector.

The primary data set used in this section is the census 2000 5 percent Public Use Micro Samples (PUMS). I look at all occupations in the health care sector except veterinarians (34 occupations, census occupation codes 300-365). I restrict my sample so that the respondents be employed, not

in school, and aged less than 65. I use the Metropolitan Statistical Area (MSA) as basic geographic units. The metropolitan areas used here contain about 76 percent of the US population.⁴

4.1 The Evidence on Equilibrium Prices

This subsection confirms the price implication in Proposition 1. I use the average annual income of an occupation as the measure for skill, and show that urban wage premiums are decreasing in skill across health care occupations and are even negative at the top skill levels. The negative urban wage premiums for high-skill occupations are the key evidence in this paper that does not follow from productivity spillover theories.

Table 1 reports the average annual income by city size for selected occupations.⁵ These occupations constitute the top and the bottom three occupations in the skill hierarchy. Large, medium, and small cities indicate the top third, the medium third, and the bottom third metropolitan areas in terms of population size, and each group contains about the same size of population.⁶ The rural areas have about 17 percent of the whole US. population.⁷ Table 1 clearly shows that high-skill workers are paid less in large cities while low-skill workers are paid more. The ratios of incomes between the large cities and the small cities are strictly less than 1 for all the top three occupations, while the ratios are greater than 1 for all the bottom three occupations. A similar relationship also holds for the large cities and the rural areas.

I summarize these results using the urban wage premiums defined in Definition 1. I assume that the elasticities are constant across the different sizes of cities, and calculate the urban wage

⁴The Public Use Microdata Areas (PUMAs), the smallest geographic units in the census 5 percent PUMS, are not fine enough to fully identify MSAs. I approximate each metropolitan area with the group of PUMAs contained in the metropolitan area. I lose about 3 percent of population by dropping the PUMAs that stretch across metropolitan area borders. The original metropolitan areas have about 79 percent of the US population.

⁵Table A.1 reports the same information as Table 1 for all the health care occupations.

⁶The top third metropolitan areas include New York CMSA, Los Angeles CMSA, Chicago CMSA, Washington-Baltimore CMSA, San Francisco CMSA, Philadelphia CMSA, and Boston CMSA.

⁷As in the metropolitan areas, I approximate the rural areas with the PUMAs. I lose about 4 percent of the US population by dropping the PUMAs that stretch across rural-metropolitan area borders. The original rural areas have about 21 percent of the US population.

premium $\beta^w(\theta)$ for each occupation θ by running the following individual level regression for each occupation θ .

$$\log w_i = \alpha^w(\theta) + \beta^w(\theta) \cdot \log n_i \quad (7)$$

where w_i is individual i 's annual total income and n_i is the population size of the metropolitan area where individual i lives. The regression coefficient $\beta^w(\theta)$ captures the urban wage premium for occupation θ . The last column of Table 1 reports the urban wage premium $\beta^w(\theta)$ and its standard error for the selected occupations. The urban wage premiums are all negative for the top three occupations and all positive for the bottom three.

Now I report the urban wage premiums for all health care occupations. Figure 1 shows the urban wage premiums across all health care occupations against their average annual incomes. There exists a clear negative relationship between urban wage premium and skill. In addition, urban wage premiums are all negative for high-skill occupations with an average annual income of \$80,000 or more. This confirms the price implication in Proposition 1.

However, this downward pattern might be due to some other factors that are correlated with metropolitan area size and individual income. I control for other possible factors by running a Mincer regression for each occupation. I add to the previous regression the standard control variables such as working hours, age, squared age, race, and sex.⁸ Figure 2 shows urban wage premiums after controlling for these factors.⁹ The downward pattern remains strong. Urban wage premiums for most high-skill occupations stay negative.¹⁰

⁸More specifically, I add as regressors logged annual working hours, age, squared age, and dummy variables for sex being female and race being not white. I do not include education-level control variables because there is not much education-level variation within an occupation. In addition, a version of the Mincer regression I ran with full education-level dummies shows the same pattern as the one reported in this paper.

⁹Table A.2 reports the urban wage premiums and the coefficients on the other control variables from the Mincer regression.

¹⁰The urban wage premium for doctors becomes virtually zero. However, this zero urban wage premium is still a large discount once the cost of living difference between large cities and small cities is considered.

4.2 The Evidence on Equilibrium Quantities

This subsection confirms the quantity implication in Proposition 2. I show that high-income occupations are more concentrated in large cities compared to low-income occupations.

Table 2 shows the number of workers per 100,000 population by city size for the top and the bottom three occupations in the health care sector.¹¹ It is clear that the top three occupations are more concentrated in large cities than are the bottom three. The top three occupations have uniformly higher count ratios between the large cities and the small cities than the bottom three. The same relationship holds between the large cities and the rural areas.

I summarize the results using the urban concentration rates defined in Definition 2. I assume that the elasticities are constant across the different size of cities, and calculate the urban concentration rate $\beta^q(\theta)$ for occupation θ by running the following metropolitan-area-level regression for each occupation θ .

$$\log l(\theta, n_j) = \alpha^q(\theta) + \beta^q(\theta) \cdot \log n_j \quad (8)$$

where $l(\theta, n_j)$ is the number of workers in occupation θ in metropolitan area j , and n_j is the population size of metropolitan area j . The regression is weighted by the metropolitan area population size n_j . The regression coefficient $\beta^q(\theta)$ captures the urban concentration rate for occupation θ . The urban concentration rate $\beta^q(\theta)$ is equal to 1 if workers in occupation θ are distributed proportionately to population size. The urban concentration rate $\beta^q(\theta)$ is greater than 1 if workers in occupation θ are disproportionately concentrated in large cities, and vice versa. The last column of Table 2 reports the urban concentration rate $\beta^q(\theta)$ and its standard error for the top and bottom three occupations.¹² The urban concentration rates are higher for high-skill occupations, as Proposition 2 predicted.

¹¹Table A.3 reports the same information for all health care occupations.

¹²Table A.2 reports the urban concentration rates and their standard errors for all health care occupations.

Now I report the urban concentration rates for all health care occupations. Figure 3 shows the urban concentration rates for all health care occupations against their average annual incomes. There exists a clear positive relationship between the urban concentration rate and income, and this confirms the quantity implication in Proposition 2. In addition, the urban concentration rates are greater than 1 for most high-skill occupations with annual income of \$80,000 or more, and less than 1 for most low-skill occupations, which implies that firms substitute high-skill occupations for low-skill occupations in large cities, and vice versa in small cities.

4.3 How Much Does Ability Sorting Account for Urban Wage Premium?

The higher percentage of high-skill occupations in large cities reported in the previous subsection is the ability sorting effect on the urban wage premium, which drives up the average pay of the whole health care sector in large cities. This subsection shows that this ability sorting effect can account for 70 percent of the urban wage premium in the health care sector.

First of all, there exists an urban wage premium for the health care sector as a whole. The average annual income of health care workers living in the large cities is 17 percent higher than that of those living in the small cities (\$54,639 vs. \$46,627). The average income difference $\bar{W}^L - \bar{W}^S$ between the large cities and the small cities can be expressed as

$$\bar{W}^L - \bar{W}^S = \sum_{\theta} (\phi_{\theta}^L - \phi_{\theta}^S) \bar{W}_{\theta}^S + \sum_{\theta} \phi_{\theta}^S (\bar{W}_{\theta}^L - \bar{W}_{\theta}^S) + \sum_{\theta} (\phi_{\theta}^L - \phi_{\theta}^S) (\bar{W}_{\theta}^L - \bar{W}_{\theta}^S). \quad (9)$$

where \bar{W}_{θ}^i is the average income of occupation θ in area i ($i = L$ for the large cities and $i = S$ for the small cities), and ϕ_{θ}^i is the quantity share of occupation θ in area i ($\phi_{\theta}^i \equiv l_{\theta}^i / \sum_{\theta} l_{\theta}^i$ where l_{θ}^i is the number of workers in occupation θ in area i).

There are three terms in the decomposition (9). The first term $\sum_{\theta} (\phi_{\theta}^L - \phi_{\theta}^S) \bar{W}_{\theta}^S$ is the contribution of quantity variation between occupations. This term captures the ability sorting effect

in the urban wage premium. Note that this term would disappear if the skill shares are the same between the large cities and the small cities. The second term $\sum_{\theta} \phi_{\theta}^S (\bar{W}_{\theta}^L - \bar{W}_{\theta}^S)$ is the contribution of wage variation within occupations. Note that this term would disappear if the average wage for each occupation were equal between the large cities and the small cities. The third term $\sum_{\theta} (\phi_{\theta}^L - \phi_{\theta}^S) (\bar{W}_{\theta}^L - \bar{W}_{\theta}^S)$ is the covariance term which shows how the wage changes between the large cities and the small cities are correlated with the quantity share changes. My theory predicts this covariance term to be negative because high-skill workers are concentrated more in large cities but paid less there. The following table summarizes the decomposition results in absolute terms and percentage terms.

$\bar{W}^L - \bar{W}^S$	$\sum_{\theta} (\phi_{\theta}^L - \phi_{\theta}^S) \bar{W}_{\theta}^S$	$\sum_{\theta} \phi_{\theta}^S (\bar{W}_{\theta}^L - \bar{W}_{\theta}^S)$	$\sum_{\theta} (\phi_{\theta}^L - \phi_{\theta}^S) (\bar{W}_{\theta}^L - \bar{W}_{\theta}^S)$
\$8,012	\$5,626	\$3,260	-\$874
100%	70%	41%	-11%

The decomposition result shows that the ability sorting effect — quantity variations across occupations — accounts for 70 percent of the urban wage premium. The covariance term is negative, and this confirms the theoretical prediction that the wage changes within occupations are negatively correlated with the quantity share changes between occupations.

5 A Focus on Doctors

The previous section examined the theoretical implications across different occupations in the health care sector. However, there exists sizeable heterogeneity even within an occupation. For example, within doctors there are different specialties, and even within the same specialties doctors may vary in their quality. This section investigates the theoretical implications just with respect to

doctors, but in two different subdimensions. Subsection 1 examines the theoretical implications with respect to the doctors of different specialties. Subsection 2 examines the quantity implication with respect to the doctors of different quality measured by the quality of medical school attended. These empirical results are not only consistent with the theoretical predictions, but also strengthen the results from the previous section. Doctors in large cities are paid less even though they are more likely to be high-skill specialists from top medical schools.

The primary data sets used in this section are the Community Tracking Study (CTS) physician survey 2000 - 2001 and a year 2000 version of the American Medical Association (AMA) physicians' master file. I use the CTS data set to confirm the price implication. The CTS is a micro data set that contains 12,406 physicians from 60 sites (51 metropolitan areas and 9 nonmetropolitan areas) randomly selected to be representative of the nation as a whole.¹³ The CTS data set has more detailed occupation specific information for doctors than the census data, such as specialty, board certification, hospital ownership, etc.

I use the AMA data set to confirm the implication for equilibrium quantities. The AMA data set has very detailed information on most physicians in the US, such as practice locations, specialty, and medical school attended.¹⁴ I use the AMA data set to confirm the quantity implication because the CTS data does not cover all of the US. I cannot use the AMA data set to confirm the price implication because it does not have income information.

I aggregate medical specialties into 4 groups for both data sets following the standard classification scheme — general practice/family physician, medical specialties, surgical specialties, and other specialties. The second column of Table 3 shows the average annual income for each spe-

¹³They restrict their sample to the physicians providing direct patient care more than 20 hours per week, excluding federal employees, foreign medical school graduates who are only temporarily licensed to practice in the US, and specialists in fields where the primary focus is not direct patient care.

¹⁴The AMA data set covers most physicians, including AMA members and nonmembers, and graduates of foreign medical schools who satisfy the requirements to be recognized as physicians in US.

cialty. Across specialties, surgical specialties make the highest income and general practice/family physician make the least.

5.1 Across Different Medical Specialties

This subsection confirms the theoretical predictions across different specialties among doctors. First, I start with the price implication: urban wage premiums are negative across the doctors of all specialties, and high-pay specialty doctors have lower urban wage premiums than low-pay specialty doctors.

As in Section 4.1, I calculate urban wage premiums by running the individual level regression (7) for each specialty θ . The fourth column of Table 3 reports urban wage premiums for each specialty. The urban wage premiums are negative across all specialties. In addition, the urban wage premiums decrease in skill. The urban wage premium is lowest for surgical specialties at -7.1 percent.

This negative relationship between urban wage premium and income might be due to other factors that are correlated with city size and skill. For example, doctors in small cities may be more likely to own their hospitals, and this may push up the average pay in small cities. Or, doctors in large cities may be more likely to work for universities concentrating in medical research, and this may push down average doctor wage in large cities. The detailed information provided in the CTS data set allows me to control for these factors. As regressors I add dummy variables for hospital ownership, working for universities, foreign medical school graduates, and board certification in addition to the standard control variables I used in section 4.1. The fifth column of Table 3 reports the urban wage premiums from the Mincer regressions.¹⁵ The negative relationship still remains strong.

¹⁵The full regression table is provided in Table A.4.

Second, I confirm the quantity implication: high-skill specialties are more concentrated in large cities. As in Section 4.2, I calculate the urban concentration rate for each specialty θ by running the metropolitan area level regression (8). The last column of Table 3 shows the urban concentration rate for each specialty. The results are a little mixed. The medical specialties group, which ranks second in average income, is most concentrated in large cities. However, the results are generally consistent with my theory in that general practice/family physicians are least concentrated in large cities. Hospitals in large cities substitute specialists for generalists, who are relatively low-skill.

This paper is not the first to report this pattern that large cities have relatively more specialists than small cities. Baumgardner (1988) explains this phenomenon as the division of labor arising through scale economies. This argument is certainly valid for the quantity results, but does not explain the price results that urban wage premiums are negative and decreasing in skill across specialties.

5.2 Doctor Quality

This subsection confirms the quantity implication with different quality of doctors: better quality doctors are more concentrated in large cities, even after controlling for different specialties. As the measure of doctor quality, I use the quality of medical schools attended, and show that doctors from better medical schools tend to locate more in large cities.¹⁶ I use average Medical College Admission Test (MCAT) scores of medical schools as the measure for medical school quality.

There is recent health economics literature examining physician quality across geographic areas, but most of studies look at the quality difference across different states (e.g., Baicker and Chandra (2004), Jencks et al. (2000), Fisher and Skinner (2001)). My work here is different in that I look at the quality difference across different-sized cities.

¹⁶The average MCAT scores are obtained from *US News & World Report - Best Graduate Schools*. In this section I use year 2001 MCAT scores, but the results are robust with all the other years I tried - 2002 and 2003.

Using the AMA data set, I calculate urban concentration rate for the graduates of each medical school θ by running the metropolitan area regression (8). Figure 4 shows the relationship between urban concentration rates and average MCAT scores of the medical schools. There exists a clear positive relationship, which means that doctors from better medical schools are more concentrated in large cities.

However, this upward trend may arise for other reasons. First, top medical schools tend to produce relatively more specialists than generalists, and large cities need relatively more specialists as compared with small cities. I resolve this issue by showing that the upward trend persists within each specialty. Second, top medical schools tend to be located in large cities and their graduates locate near their medical schools. Figure 5 shows the geographic distribution of doctors from University of Illinois medical schools; they are heavily concentrated in Illinois. I resolve this issue by focusing only on migrant doctors. More specifically, I calculate urban concentration rate for each medical school using only the observations at least 500 miles away from the school.¹⁷ Figure 6 shows the urban concentration rates across medical schools in each specialty after controlling for doctors' geographic concentration near their medical schools. The positive pattern remains strong for each specialty.

6 Discussion

The key pieces of evidence for this paper are the negative urban wage premiums for high-skill health care occupations. However, there may be other explanations than consumption variety for these negative urban wage premiums. Moreover, it turns out that some high-skill occupations such as lawyers do not show negative urban wage premium. This section examines two alternative

¹⁷For each medical school I drop all observations in any metropolitan areas whose distance from the school is less than 500 miles. The distances between medical schools and metropolitan areas are calculated using the ZIP code of the medical school and the latitude and longitude of the metropolitan areas provided in the census data geographic file.

explanations for the negative urban wage premiums and discusses why we do not observe a negative urban wage premium for lawyers.

6.1 Human Capital Accumulation

Glaeser and Mare (2001) show that wages tend to grow more quickly in large cities. One explanation for the negative urban wage premiums is that young high-skill workers anticipating this faster wage growth may stay in large cities despite the low current wages. I examine this hypothesis by looking at those aged 50 years or above for whom this human capital accumulation effect should not play a big role.

I calculate the urban wage premiums by running the Mincer regression in section 4.1, but this time only with those aged between 50 and 65. Figure 7 shows the urban wage premiums against average occupation incomes. Urban wage premiums stay negative for most high-skill occupations except doctors. Moreover, the urban wage premium for doctors is just 1 percent, which is still a large discount when the cost of living differences across urban and rural areas are considered. This discount would get even larger if one could control for doctors' quality differences across different-sized cities. Human capital accumulation seems to play some role in the negative urban wage premiums, but is not strong enough to fully account for the evidence provided in this paper.

6.2 Colocation problem

Another explanation for the negative urban wage premiums is the colocation problem for high-skill workers. The spouses of high-skill workers are also likely to be high-skill workers. These high-skill dual career couples may have difficulty finding jobs for both of them in small cities because their jobs tend to be specialized and small cities do not have many high-skill jobs (See Costa and Kahn (2000)). This colocation problem decreases the supply of high-skill workers in small cities, raising

their wages.

The evidence provided in this paper does not distinguish my theory from this colocation theory. However, this colocation problem has the same implication for the urban wage premium as my theory. That is, both theories imply that the demand for living in big cities is a normal good, and they both lead to ability sorting across different-sized cities.

6.3 Lawyers

Lawyers are arguably the most similar occupation to doctors outside the health care sector. They earn high incomes and their jobs are highly specialized. However, it turns out that their urban wage premium is not negative. According to the census data, the urban wage premium of lawyers is 7.1 percent while the urban wage premium for doctors is -3.2 percent. I claim that the urban wage premium of lawyers is much higher than that of doctors due to the following two reasons.

The first is that there is not much need for lawyers in small cities as compared with doctors. The census data shows that the small cities have only half as many lawyers per capita as the large cities while they have 83 percent as many doctors.¹⁸ This relatively small demand for lawyers in small cities lowers the financial inducement necessary to bring them to live in small cities, and makes the urban wage premium of lawyers higher than that of doctors.

The second reason for the higher urban wage premium of lawyers is that the lawyers in small cities are noticeably less skilled than their peers in large cities, as compared with doctors. For example, the smallest MSA in the census data is Enid, Oklahoma with population 57,813. Even this small city needs to have top-skill specialty doctors because patients may not have time to drive to big cities for emergencies. Anesthesiologists and surgeons, for example, are the top two medical

¹⁸The large cities have 4.6 lawyers per 1000 population while the small cities have 2.3 lawyers. In contrast, the large cities have 29 doctors per 1000 and the small cities have 24 doctors.

specialties with respect to income.¹⁹ The AMA data set shows that Enid has three anesthesiologists and five surgeons, including one cardiovascular surgeon. In contrast, there is not much demand for top-skill specialty lawyers in small cities because their clients, if any, can go to nearby big cities. For example, Enid does not have any lawyers in finance, investment, or intellectual property (Martindale-Hubbel legal directory).

7 Conclusion

This paper provides an ability sorting explanation for the urban wage premium driven by the consumption side of cities. The key idea is that the demand for consumption variety is more income elastic than the demand for residential land. That is, as one becomes richer and richer, one spends a higher fraction of one's income on differentiated local goods. Therefore, high-skill workers care more about consumption variety, and select to live in large cities. A testable implication of the theory, distinguished from the productivity spillover theories, is that there may exist urban wage discounts for high-skill workers. This implication is confirmed by the health care sector data. I find that high-skill health care workers in large cities are paid less than their peers in small cities. I also find that ability sorting accounts for 70 percent of the urban wage premium for the whole health care sector.

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Table 1. Average Annual Income by City Size (in Thousand Dollars) and Urban Wage Premium For Top and Bottom Skill Occupations in the Health Care Sector

Occupation	Rural Areas	Small Cities	Medium Cities	Large Cities	The Ratio Between Large Cities and Small Cities	The Ratio Between Large Cities and Rural Areas	Urban Wage Premium
Physicians and Surgeons	170	167	162	154	0.92	0.91	-3.18% (0.43%)
Dentists	146	158	149	144	0.91	0.99	-4.44% (0.91%)
Podiatrists	108	140	118	117	0.84	1.09	-6.85% (3.50%)
Dental Assistants	18	20	23	22	1.09	1.21	1.84% (0.56%)
Massage Therapists	17	20	20	25	1.23	1.45	3.26% (1.53%)
Nursing, Psychiatric, and Home Health Aides	16	19	21	23	1.20	1.41	4.54% (0.25%)

Large, medium, and small cities indicate the top third, the medium third, and the bottom third metropolitan areas in terms of population size.

Source: Census 2000 5 percent Public Use Micro Sample

**Table 2. The Number of Workers per 100,000 Population by City Size
For Top and Bottom Skill Occupations in the Health Care Sector**

Occupation	Rural Areas	Small Cities	Medium Cities	Large Cities	The Ratio Between Large Cities and Small Cities	The Ratio Between Large Cities and Rural Areas	Urban Concentration Rate
Physicians and Surgeons	117	238	250	292	1.23	2.50	1.08 (0.01)
Dentists	35	48	49	64	1.33	1.84	1.11 (0.02)
Podiatrists	2	3	4	5	1.64	3.02	1.03 (0.05)
Dental Assistants	62	62	64	63	1.02	1.01	1.02 (0.01)
Massage Therapists	16	20	26	21	1.04	1.30	1.01 (0.03)
Nursing, Psychiatric, and Home Health Aides	618	475	378	457	0.96	0.74	0.98 (0.02)

Large, medium, and small cities indicate the top third, the medium third, and the bottom third metropolitan areas in terms of population size.

Source: Census 2000 5 percent Public Use Micro Sample

**Table 3. Urban Wage Premiums and Urban Concentration Rates
Across Doctors With Different Specialties**

Occupation	Average Annual Net Income (\$1,000)	Number of Observations	Urban Wage Premium	Urban Wage Premium (Mincer Regression)	Urban Concentration Rate
All	179	9,710	-5.3% (0.8%)	-3.1% (0.6%)	1.07 (0.02)
Surgical Specialties	232	1,394	-7.1% (1.9%)	-4.4% (1.5%)	1.04 (0.02)
Medical Specialties	171	5,470	-4.7% (1%)	-3.3% (1%)	1.14 (0.02)
Other Specialties	141	408	-2.4% (3.2%)	-1.5% (2.7%)	1.09 (0.02)
General Practice / Family Physicians	131	2,438	-3.9% (1.3%)	-1.9% (1.2%)	0.90 (0.02)

Source: Community Tracking Study Physician Survey 2000-2001

**Figure 1. The Relationship between Urban Wage Premium and Skill
Across All Health Care Occupations**

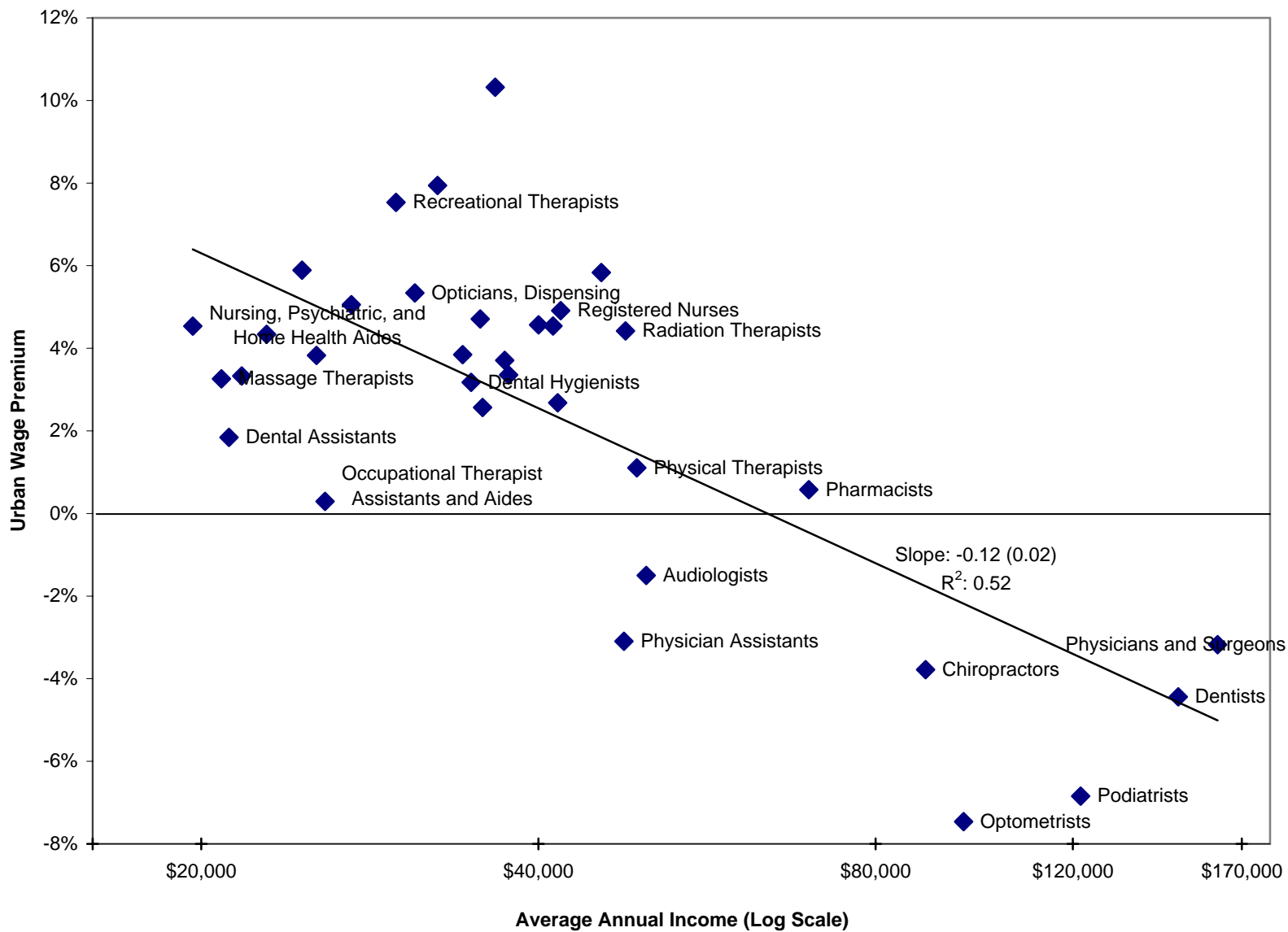
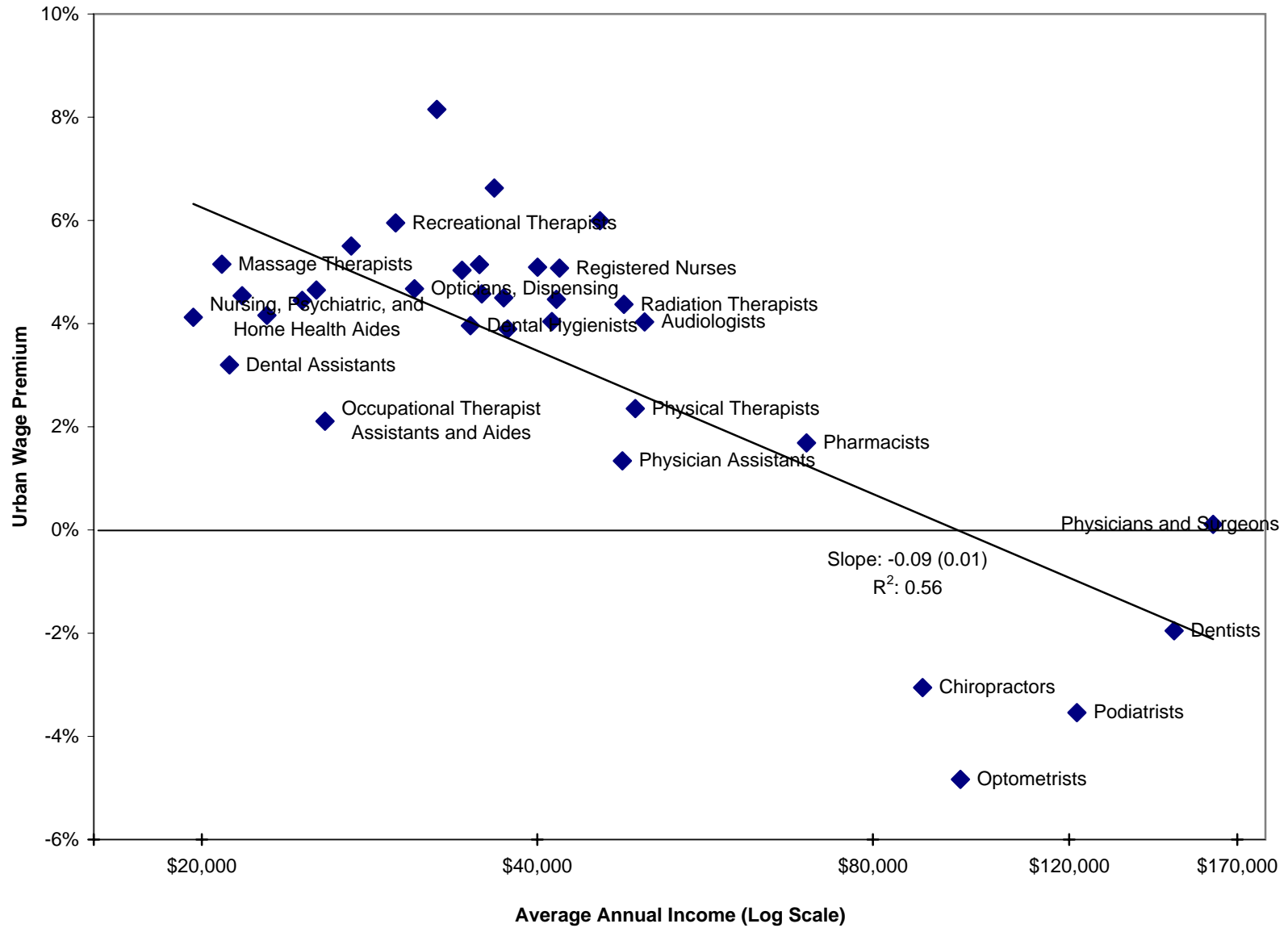
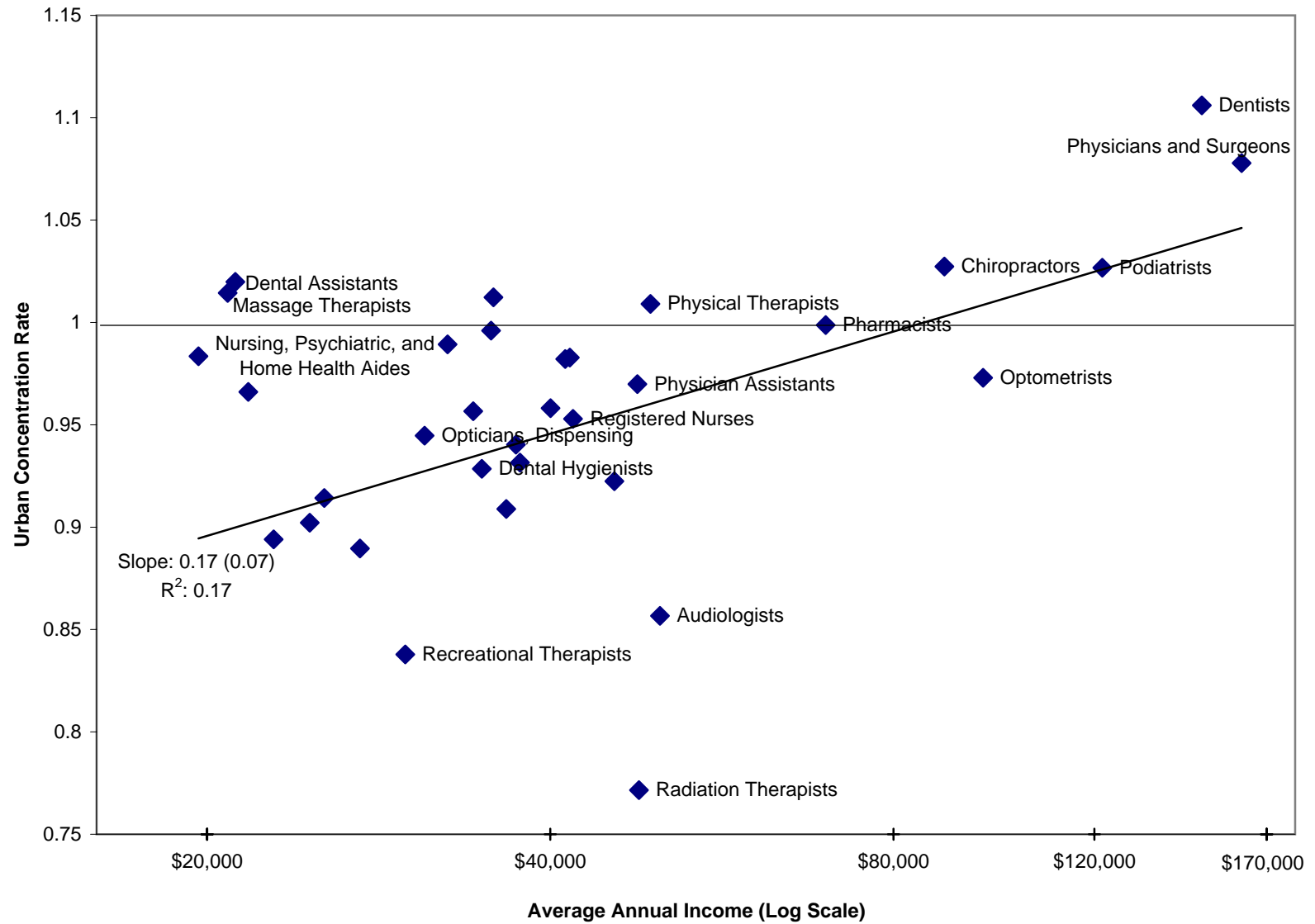


Figure 2. The Relationship between Urban Wage Premium and Skill Across All Health Care Occupations from the Mincer Regressions



**Figure 3. The Relationship between Urban Concentration Rate and Skill
Across All Health Care Occupations**



**Figure 4. Urban Concentration Rate and Average MCAT Score
Across Medical Schools**

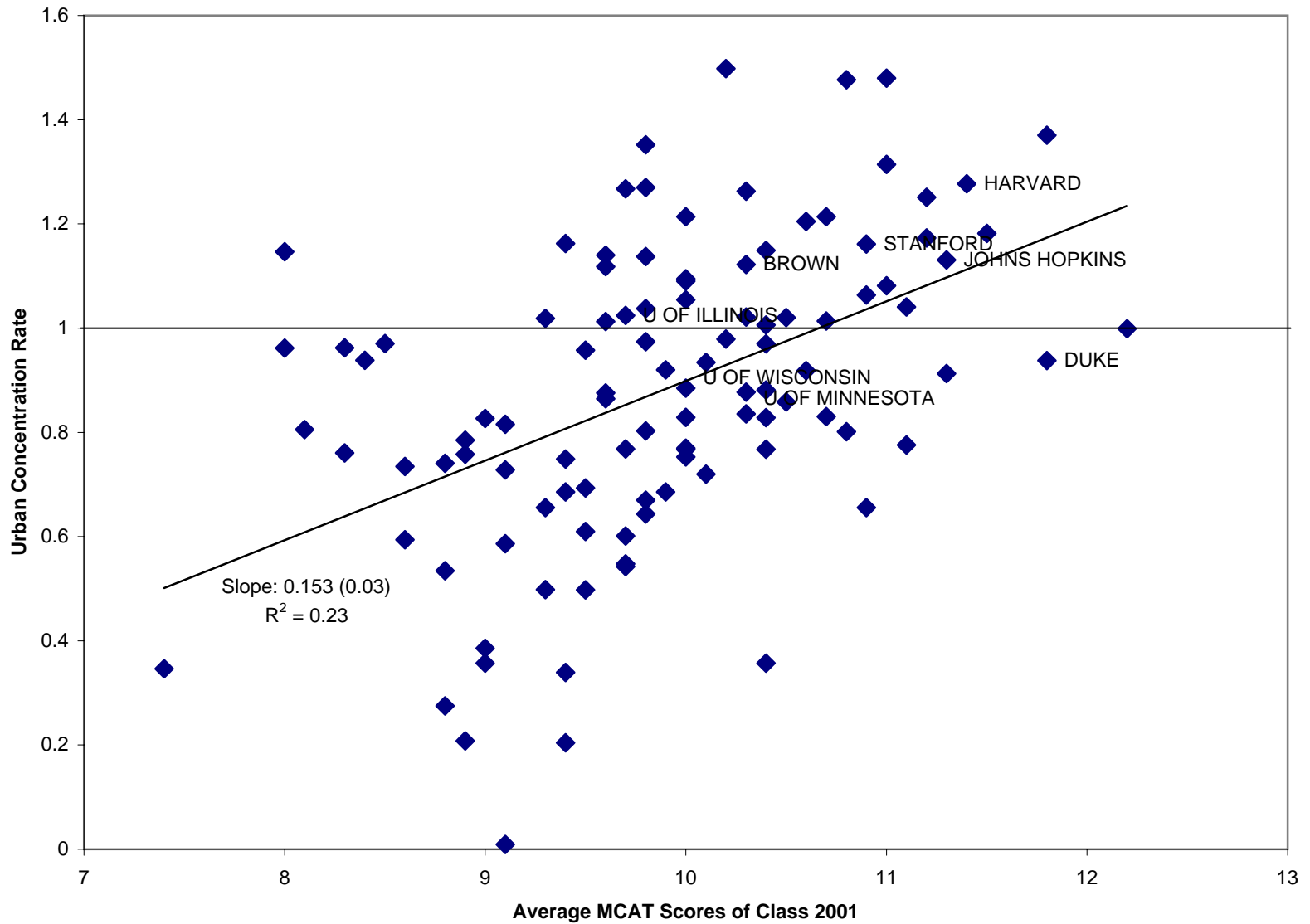
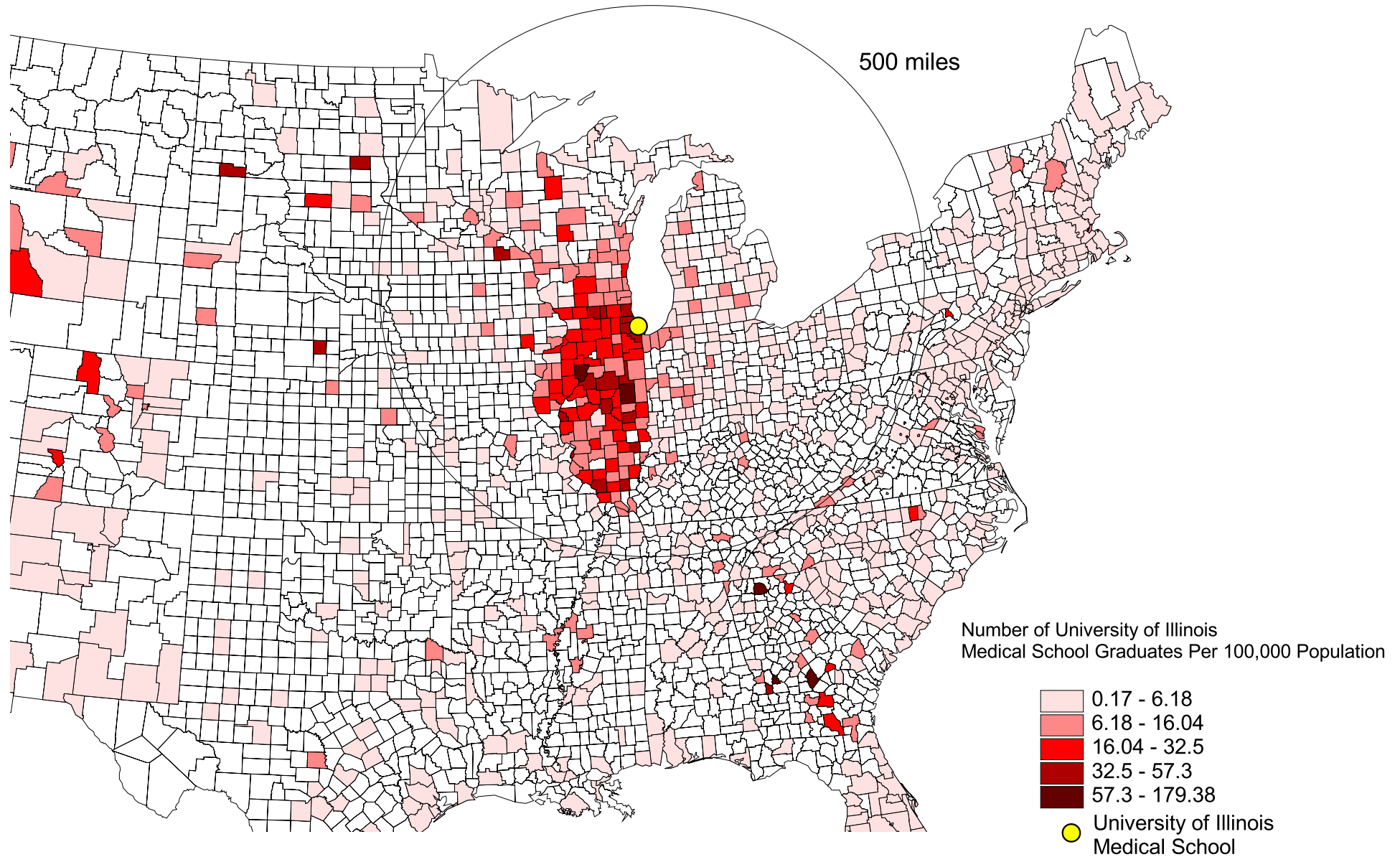
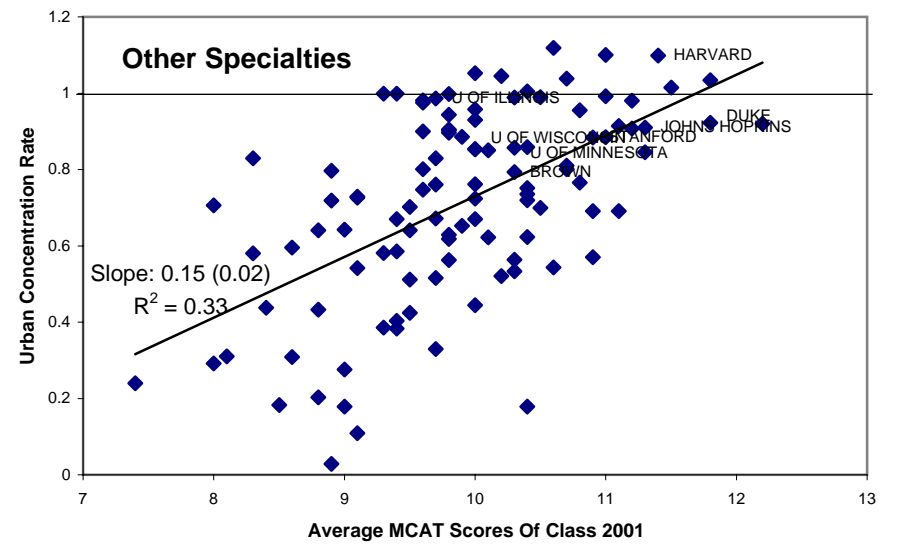
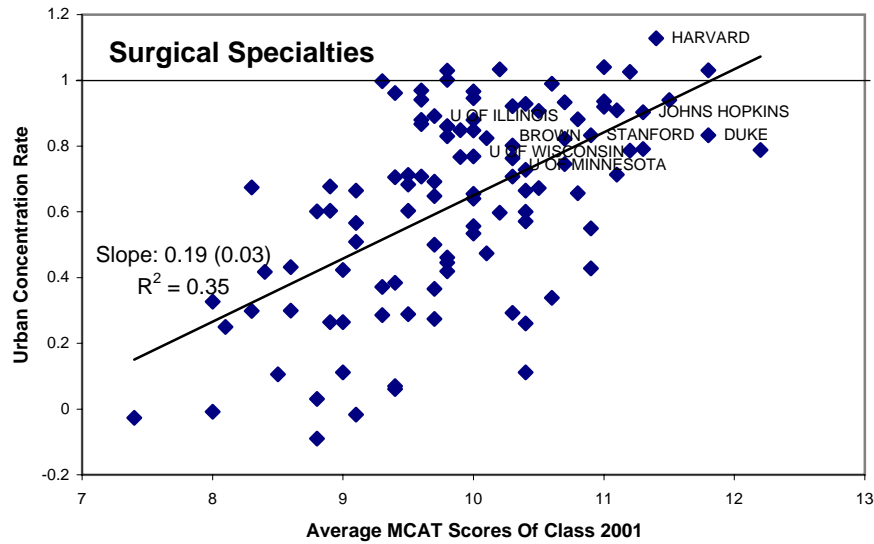
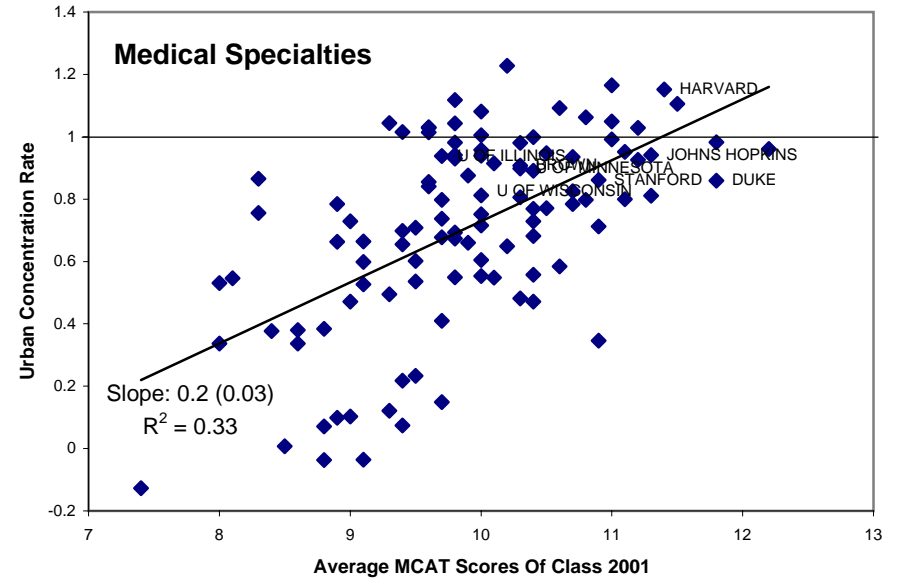
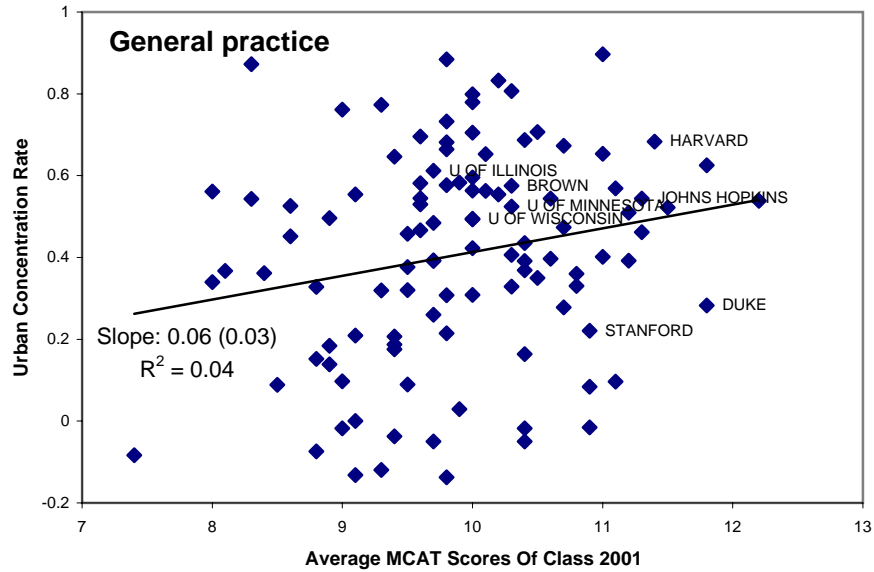


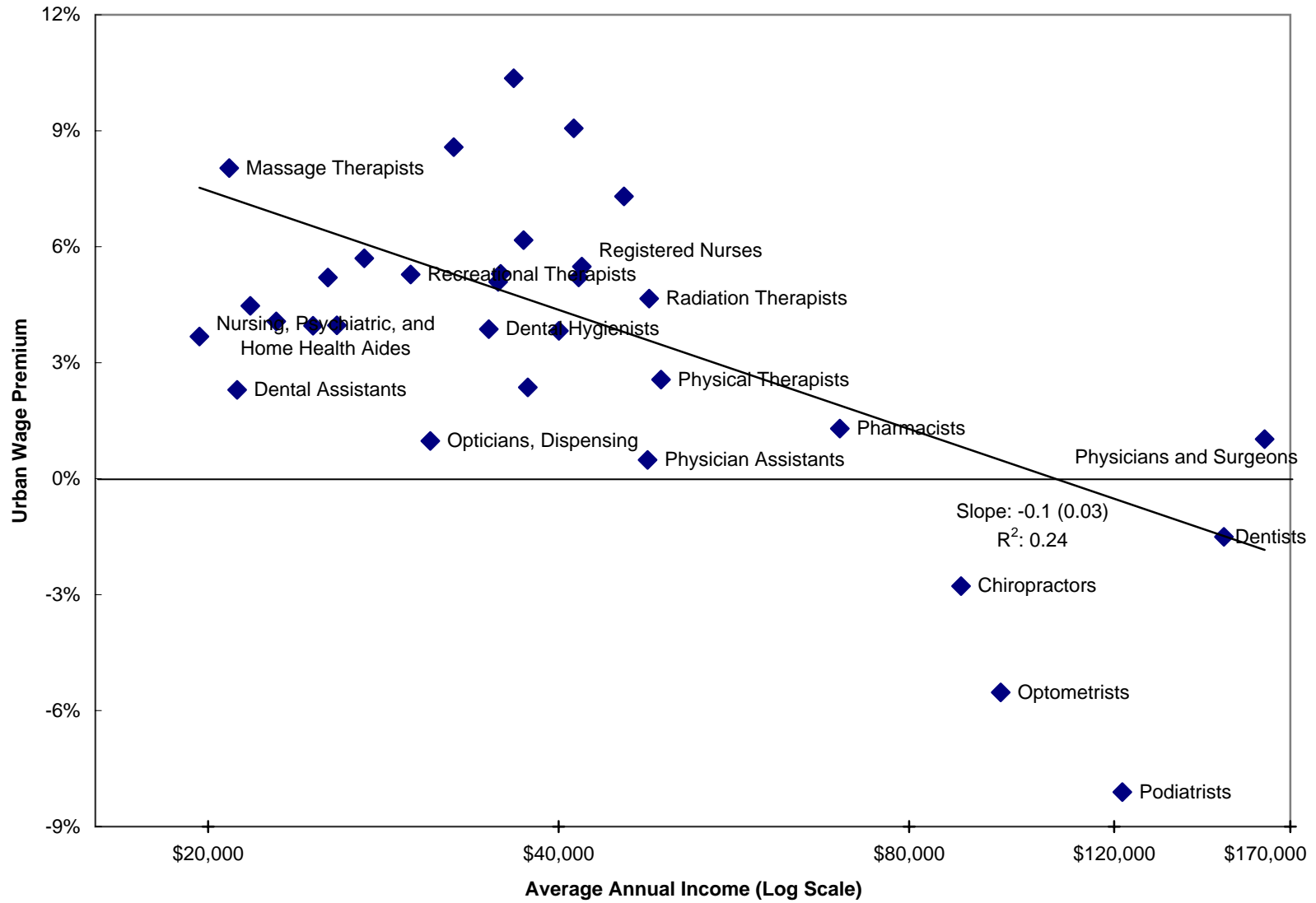
Figure 5. Geographic Distribution Of Doctors
University of Illinois Medical School Graduates



**Figure 6. Urban Concentration Rate and Average MCAT Score
By Specialty, For Doctors Practicing More Than 500 Miles Away from Their Medical Schools**



**Figure 7. The Relationship Between Urban Wage Premium and Skill
From the Mincer Regressions for Those Aged Between 50 and 65**



**Table A.1. Average Annual Income by City Size (in Thousand Dollars) and Urban Wage Premium
For All Health Care Occupations**

Occupation (in Descending Order by Income)	Average Income	Rural Areas	Small Cities	Medium Cities	Large Cities	Urban Wage Premium
Physicians and Surgeons	162	170	167	162	154	-3.18% (0.43%)
Dentists	149	146	158	149	144	-4.44% (0.91%)
Podiatrists	122	108	140	118	117	-6.85% (3.50%)
Optometrists	96	106	105	94	84	-7.46% (1.85%)
Chiropractors	89	91	99	87	80	-3.78% (1.88%)
Pharmacists	70	73	69	68	71	0.58% (0.59%)
Audiologists	50	40	49	52	52	-1.50% (2.52%)
Physical Therapists	49	46	49	47	52	1.11% (0.80%)
Radiation Therapists	48	46	49	47	48	4.42% (1.98%)
Physician Assistants	48	48	49	45	49	-3.09% (1.36%)
Other Health Care Practitioners and Technical Occupations	46	39	43	47	51	5.83% (1.09%)
Registered Nurses	42	36	40	42	48	4.91% (0.16%)
Speech-Language Pathologists	42	38	40	42	46	2.68% (0.84%)
Occupational Therapists	41	39	40	40	45	4.54% (1.06%)
Miscellaneous Health Technologists and Technicians	40	31	39	41	46	4.57% (1.12%)
Respiratory Therapists	38	32	37	37	43	3.36% (0.69%)
Diagnostic Related Technologists and Technicians	37	33	36	38	42	3.71% (0.49%)
Health Diagnosing and Treating Practitioners, All Other	37	27	29	31	46	10.32% (4.74%)
Therapists, All Other	36	30	34	37	39	2.57% (1.18%)
Clinical Laboratory Technologists and Technicians	35	32	33	35	40	4.71% (0.46%)
Dental Hygienists	35	31	33	36	38	3.17% (0.76%)
Emergency Medical Technicians and Paramedics	34	30	34	36	38	3.85% (0.93%)
Dietitians and Nutritionists	33	27	31	32	38	7.94% (1.09%)
Opticians, Dispensing	31	25	31	29	38	5.34% (1.25%)
Recreational Therapists	30	28	28	29	34	7.53% (1.99%)
Licensed Practical and Licensed Vocational Nurses	27	24	26	29	32	5.06% (0.35%)
Occupational Therapist Assistants and Aides	26	24	27	24	28	0.29% (2.16%)
Physical Therapist Assistants and Aides	25	22	24	27	28	3.83% (1.31%)
Medical Records and Health Information Technicians	25	20	24	25	29	5.89% (0.93%)
Health Diagnosing and Treating Practitioner Support Technicians	23	20	22	22	27	4.34% (0.54%)
Medical Assistants and Other Health Care Support Occupations	22	18	21	22	24	3.33% (0.40%)
Dental Assistants	21	18	20	23	22	1.84% (0.56%)
Massage Therapists	21	17	20	20	25	3.26% (1.53%)
Nursing, Psychiatric, and Home Health Aides	20	16	19	21	23	4.54% (0.25%)

Source: Census 2000 5 percent Public Use Micro Sample

**Table A.2. City Size and Other Determinants of Individual Income
For All Health Care Occupations**

Occupation (in Descending Order by Income)	Urban Wage Premium	Logged Working Hours	Female	Non-White	Age	Age ²	R ²	N
Physicians and Surgeons	0.001 (0.004)	0.44 (0.01)	-0.31 (0.01)	-0.14 (0.01)	0.25 (0.004)	-0.0024 (0.00005)	0.31	24904
Dentists	-0.02 (0.01)	0.43 (0.03)	-0.46 (0.03)	-0.20 (0.03)	0.12 (0.01)	-0.0011 (0.00012)	0.18	5240
Podiatrists	-0.04 (0.03)	0.56 (0.12)	-0.41 (0.13)	-0.17 (0.16)	0.25 (0.05)	-0.0025 (0.00054)	0.25	410
Optometrists	-0.05 (0.02)	0.56 (0.05)	-0.29 (0.05)	-0.14 (0.06)	0.06 (0.02)	-0.0005 (0.00022)	0.30	942
Chiropractors	-0.03 (0.02)	0.61 (0.06)	-0.36 (0.06)	0.03 (0.11)	0.18 (0.02)	-0.0018 (0.00026)	0.19	1626
Pharmacists	0.02 (0.005)	0.74 (0.01)	-0.17 (0.01)	-0.04 (0.02)	0.03 (0.005)	-0.0002 (0.00006)	0.39	6165
Audiologists	0.04 (0.02)	0.69 (0.06)	-0.24 (0.08)	-0.08 (0.13)	0.06 (0.02)	-0.0005 (0.00030)	0.39	412
Physical Therapists	0.02 (0.01)	0.82 (0.01)	-0.12 (0.02)	-0.02 (0.02)	0.07 (0.01)	-0.0007 (0.00008)	0.52	4273
Radiation Therapists	0.04 (0.02)	0.64 (0.06)	-0.16 (0.05)	-0.01 (0.08)	0.06 (0.02)	-0.0006 (0.00024)	0.36	336
Physician Assistants	0.01 (0.01)	0.72 (0.03)	-0.29 (0.03)	-0.14 (0.04)	0.07 (0.01)	-0.0007 (0.00013)	0.39	1721
Other Health Care Practitioners and Technical Occupations	0.06 (0.01)	0.62 (0.03)	-0.22 (0.03)	-0.17 (0.03)	0.06 (0.01)	-0.0006 (0.00011)	0.35	1872
Registered Nurses	0.05 (0.001)	0.71 (0.004)	-0.12 (0.01)	0.02 (0.00)	0.04 (0.001)	-0.0004 (0.00002)	0.41	68936
Speech-Language Pathologists	0.04 (0.01)	0.79 (0.02)	-0.11 (0.04)	0.00 (0.03)	0.05 (0.01)	-0.0005 (0.00009)	0.45	3017
Occupational Therapists	0.04 (0.01)	0.75 (0.02)	-0.13 (0.04)	0.06 (0.04)	0.06 (0.01)	-0.0006 (0.00012)	0.52	2127
Miscellaneous Health Technologists and Technicians	0.05 (0.01)	0.66 (0.03)	-0.39 (0.03)	-0.15 (0.03)	0.06 (0.01)	-0.0005 (0.00011)	0.32	2416
Respiratory Therapists	0.04 (0.01)	0.72 (0.02)	-0.11 (0.02)	-0.01 (0.02)	0.03 (0.01)	-0.0002 (0.00008)	0.40	2565
Diagnostic Related Technologists and Technicians	0.05 (0.004)	0.71 (0.01)	-0.17 (0.01)	-0.04 (0.02)	0.05 (0.004)	-0.0005 (0.00005)	0.41	7017
Health Diagnosing and Treating Practitioners, All Other	0.07 (0.05)	0.61 (0.08)	-0.10 (0.12)	0.09 (0.13)	0.09 (0.05)	-0.0011 (0.00054)	0.18	312
Therapists, All Other	0.05 (0.01)	0.66 (0.02)	-0.12 (0.03)	-0.06 (0.04)	0.07 (0.01)	-0.0006 (0.00012)	0.36	2070
Clinical Laboratory Technologists and Technicians	0.05 (0.004)	0.75 (0.01)	-0.12 (0.01)	-0.07 (0.01)	0.06 (0.003)	-0.0005 (0.00004)	0.42	8708
Dental Hygienists	0.04 (0.01)	0.73 (0.01)	-0.10 (0.06)	-0.01 (0.03)	0.03 (0.01)	-0.0003 (0.00008)	0.45	3676
Emergency Medical Technicians and Paramedics	0.05 (0.01)	0.65 (0.02)	-0.23 (0.02)	-0.01 (0.03)	0.08 (0.01)	-0.0008 (0.00011)	0.42	2472
Dietitians and Nutritionists	0.08 (0.01)	0.80 (0.02)	-0.06 (0.05)	-0.23 (0.03)	0.04 (0.01)	-0.0004 (0.00010)	0.42	2333
Opticians, Dispensing	0.05 (0.01)	0.86 (0.03)	-0.27 (0.03)	-0.05 (0.04)	0.05 (0.01)	-0.0004 (0.00010)	0.43	1502
Recreational Therapists	0.06 (0.01)	0.73 (0.04)	-0.11 (0.05)	-0.01 (0.06)	0.07 (0.02)	-0.0008 (0.00020)	0.50	478
Licensed Practical and Licensed Vocational Nurses	0.06 (0.003)	0.70 (0.01)	-0.14 (0.02)	-0.05 (0.01)	0.03 (0.003)	-0.0003 (0.00003)	0.40	14911
Occupational Therapist Assistants and Aides	0.02 (0.02)	0.56 (0.04)	0.03 (0.08)	0.08 (0.07)	0.03 (0.02)	-0.0003 (0.00028)	0.39	294
Physical Therapist Assistants and Aides	0.05 (0.01)	0.76 (0.03)	-0.08 (0.03)	-0.04 (0.04)	0.07 (0.01)	-0.0008 (0.00013)	0.46	1223
Medical Records and Health Information Technicians	0.04 (0.01)	0.69 (0.02)	-0.18 (0.04)	0.01 (0.02)	0.04 (0.01)	-0.0003 (0.00008)	0.36	2721
Health Diagnosing and Treating Practitioner Support Technicians	0.04 (0.004)	0.78 (0.01)	-0.18 (0.02)	0.03 (0.01)	0.05 (0.004)	-0.0005 (0.00004)	0.46	7447
Medical Assistants and Other Health Care Support Occupations	0.05 (0.003)	0.75 (0.01)	-0.14 (0.01)	-0.03 (0.01)	0.05 (0.003)	-0.0004 (0.00003)	0.45	15763
Dental Assistants	0.03 (0.004)	0.74 (0.01)	-0.24 (0.04)	-0.06 (0.02)	0.05 (0.004)	-0.0005 (0.00005)	0.42	6154
Massage Therapists	0.05 (0.01)	0.53 (0.02)	-0.13 (0.05)	-0.10 (0.06)	0.03 (0.01)	-0.0003 (0.00015)	0.24	2148
Nursing, Psychiatric, and Home Health Aides	0.04 (0.002)	0.71 (0.005)	-0.20 (0.01)	-0.02 (0.01)	0.03 (0.002)	-0.0003 (0.00002)	0.39	41289

Source: Census 2000 5 percent Public Use Micro Sample

**Table A.3. Number of Workers (per 100,000) By City Size and Urban Concentration Rate
For All Health Care Occupations**

Occupation (in Descending Order by Income)	Rural Areas	Small Cities	Medium Cities	Large Cities	Urban Concentration Rate
Physicians and Surgeons	117	238	250	292	1.08 (0.01)
Dentists	35	48	49	64	1.11 (0.02)
Podiatrists	2	3	4	5	1.03 (0.05)
Optometrists	9	9	10	10	0.97 (0.02)
Chiropractors	13	16	18	18	1.03 (0.03)
Pharmacists	52	68	66	60	1.00 (0.02)
Audiologists	2	5	4	4	0.86 (0.04)
Physical Therapists	33	45	45	45	1.01 (0.02)
Radiation Therapists	14	18	19	16	0.77 (0.04)
Physician Assistants	2	4	3	3	0.97 (0.02)
Other Health Care Practitioners and Technical Occupations	19	21	20	17	0.92 (0.02)
Registered Nurses	625	771	695	665	0.95 (0.01)
Speech-Language Pathologists	26	34	29	30	0.98 (0.02)
Occupational Therapists	13	23	23	21	0.98 (0.03)
Miscellaneous Health Technologists and Technicians	19	29	26	23	0.96 (0.02)
Respiratory Therapists	24	31	27	21	0.93 (0.02)
Diagnostic Related Technologists and Technicians	62	82	72	62	0.94 (0.01)
Health Diagnosing and Treating Practitioners, All Other	1	2	3	5	0.91 (0.08)
Therapists, All Other	19	21	21	23	1.01 (0.02)
Clinical Laboratory Technologists and Technicians	70	95	91	86	1.00 (0.01)
Dental Hygienists	28	43	40	30	0.93 (0.02)
Emergency Medical Technicians and Paramedics	44	28	25	23	0.96 (0.02)
Dietitians and Nutritionists	22	27	22	23	0.99 (0.02)
Opticians, Dispensing	14	17	17	13	0.94 (0.02)
Recreational Therapists	5	6	4	5	0.84 (0.05)
Licensed Practical and Licensed Vocational Nurses	248	190	143	119	0.89 (0.02)
Occupational Therapist Assistants and Aides	4	5	3	2	0.55 (0.06)
Physical Therapist Assistants and Aides	17	14	13	11	0.91 (0.02)
Medical Records and Health Information Technicians	29	33	31	22	0.90 (0.02)
Health Diagnosing and Treating Practitioner Support Technicians	81	93	80	61	0.89 (0.01)
Medical Assistants and Other Health Care Support Occupations	152	173	172	144	0.97 (0.01)
Dental Assistants	62	62	64	63	1.02 (0.01)
Massage Therapists	16	20	26	21	1.01 (0.03)
Nursing, Psychiatric, and Home Health Aides	618	475	378	457	0.98 (0.02)

Source: Census 2000 5 percent Public Use Micro Sample

Table A.4 City Size and Other Determinants of Doctors' Income

	All	General Practice / Family Physicians	Other Specialties	Medical Specialties	Surgical Specialties
Average Annual Income (In Thousand Dollars)	179	131	141	171	232
Urban Wage Premium (Logged Population Size)	-3.28% (0.64%)	-1.94% (1.22%)	-1.37% (2.63%)	-3.27% (0.98%)	-4.27% (1.51%)
Logged Working Hours	0.33 (0.03)	0.38 (0.06)	1.01 (0.18)	0.19 (0.04)	0.38 (0.06)
Age	0.06 (0.01)	0.03 (0.01)	0.05 (0.03)	0.07 (0.01)	0.06 (0.02)
Squared Age	-0.0005 (0.0001)	-0.0003 (0.0001)	-0.0004 (0.0003)	-0.0007 (0.0001)	-0.0006 (0.0002)
Dummy variables:					
Female	-0.33 (0.03)	-0.34 (0.06)	-0.14 (0.09)	-0.36 (0.05)	-0.27 (0.09)
Non-White	-0.03 (0.04)	0.01 (0.05)	0.09 (0.10)	0.02 (0.05)	-0.23 (0.10)
Foreign Medical School Graduates	-0.02 (0.04)	0.01 (0.04)	-0.04 (0.10)	-0.06 (0.05)	-0.02 (0.07)
Board Certified	0.18 (0.03)	0.19 (0.04)	0.15 (0.10)	0.19 (0.06)	0.21 (0.06)
Owner of Hospital	0.09 (0.02)	0.03 (0.04)	-0.06 (0.09)	0.14 (0.04)	0.06 (0.04)
Working for Universities	0.01 (0.07)	-0.14 (0.07)	0.44 (0.18)	0.08 (0.08)	-0.06 (0.21)
General Practice / Family Physicians	-0.08 (0.05)				
Medical Specialties	0.13 (0.05)				
Surgical Specialties	0.36 (0.05)				
R ²	0.17	0.11	0.23	0.12	0.13
N	9682	2436	408	5445	1393

Source: Community Tracking Study (CTS) Physician Survey 2000-2001