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# Is There Monopsony in the Labor Market? Evidence from a Natural Experiment

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Recent theoretical and empirical advances have renewed interest in monopsonistic models of the labor market. However, there is little direct empirical support for these models. We use an exogenous change in wages at Department of Veterans Affairs (VA) hospitals as a natural experiment to investigate the extent of monopsony in the nurse labor market. We estimate that labor supply to individual hospitals is quite inelastic, with short-run elasticity around 0.1. We also find that non-VA hospitals responded to the VA wage change by changing their own wages.

## I. Introduction

Standard competitive models assume that individual firms are price takers in the labor market. However, since Robinson (1933) first coined

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the term "monopsony," economists have considered the alternative case in which individual firms face upward-sloping labor supply curves and therefore have market power that enables them to set wages. Originally, monopsony power was thought to exist primarily in fairly specialized labor markets in which a single firm bought labor in an isolated labor market (analogous to a monopolist in a product market). More recently, a variety of theoretical models have suggested that monopsonistic competition may be pervasive, with individual firms facing upward-sloping labor supply curves because of the presence of oligopoly, differentiation between firms, variation in worker preferences, moving costs, a costly job search, or efficiency wages (Boal and Ransom 1997; Bhaskar, Manning, and To 2002). Manning (2003) has argued that monopsony can help explain a wide range of labor market features, including the effects of the minimum wage, firm-size wage effects, and gender and racial wage gaps.

Empirical evidence of monopsonistic competition is quite mixed (see Boal and Ransom [1997], Bhaskar et al. [2002], and Manning [2003] for reviews). On the one hand, monopsonistic competition provides a possible explanation for a variety of facts that are difficult to explain in the competitive model. For example, monopsonistic competition has been used to explain why an increase in the minimum wage led to an increase in employment (Card and Krueger 1995; Bhaskar and To 1999), why there is a positive relationship between firm size and wages (Green, Machin, and Manning 1996), and why there are persistent differences across firms in wages and vacancy rates (Yett 1975; Card and Krueger 1995; Boal and Ransom 1997; Bhaskar and To 1999). On the other hand, direct estimation of the elasticity of labor supply to individual firms has yielded mixed results, suggesting that firms have very little market power over the wages of nurses (Sullivan 1989; Hansen 1992; Matsudaira 2009) and coal miners (Boal 1995) but some market power over the wages of teachers (Falch 2010, in this issue; Ransom and Sims 2010, in this issue).

This article investigates whether individual hospitals have monopsony power in the labor market for registered nurses (RNs). Some have argued that the RN labor market is a likely example of monopsony because of persistent variations in wages across regions and across hospitals, along with nearly continuous reports of shortages since World War II (Yett 1975; Aiken 1982; Roberts et al. 1989; Friss 1994; Greene and Nordhaus-Bike 1998). On the other hand, RNs have greater interemployer mobility than other occupations, which suggests that RNs are mobile and that

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firm-level monopsony power may be weak (Hirsch and Schumacher 2005).

We analyze the effect of an exogenous, legislated change in RN wages at Department of Veterans Affairs (VA) hospitals. Our analysis differs in two important ways from the prior literature estimating monopsony power at the firm level. First, previous studies have used measures of output demand as instruments for wages in estimating the supply elasticity. In contrast, our source of identification comes from a legislated change in wages at certain hospitals. Arguably, this legislated change in wages provides the perfect "natural experiment" with which to answer the key question: does an exogenous change in wages at one hospital affect employment at that hospital or at competing hospitals? A second difference from the prior literature is that our empirical analysis is explicitly motivated by a model of geographic differentiation among firms, similar to Salop (1979), in which hospitals compete directly only with their nearest neighbors. In this model, geographic differentiation can be generalized as the subjective disutility the worker suffers with each employer (Bhaskar and To 1999), with transportation costs being one of the sources of disutility.[1] This model suggests that other hospitals will change their wages in response to the VA wage change and that the response will be largest at hospitals that are nearest to the VA hospital.

Our empirical results are consistent with the presence of monopsony power in the RN labor market, in large part generated by geographic differentiation between hospitals. We find that wages at non-VA hospitals responded to the VA wage change and that this response was largest among hospitals located within 15 miles of a VA hospital. In addition, we find that RN employment at individual hospitals responded very little in the short run to the resulting changes in relative wages between hospitals. Our estimates of the short-run elasticity of labor supply to an individual hospital average around 0.1, far lower than previous estimates in the literature. Overall, this evidence suggests that hospitals are wage setters in the RN labor market, with considerable market power.

## II. Previous Studies of Monopsony in Nursing

Studies of monopsonistic competition in the nursing labor market have been motivated by two observations. First, in rural regions, there may be only one hospital and few other employers for RNs, potentially providing RN employers with market power. Second, as stated above, there have been persistent reports of nursing shortages since the 1940s. Research on

[1] Bhaskar and To (1999) suggest that disutility to the worker can arise from differences between worker preferences and employer characteristics. Transportation costs can underlie these differences.

nursing labor markets has provided conflicting evidence about the monopsony hypothesis.

Studies of nursing monopsony generally have taken two approaches. One line of literature has examined whether there is a cross-sectional relationship between wage levels and either labor market concentration or measures of worker mobility suggested by the "new monopsony" literature (Manning 2003). Several studies have found that RN wages are lower when there are fewer hospitals or when hospital markets are more concentrated (Hurd 1973; Link and Landon 1975; Bruggink et al. 1985; Robinson 1988). However, studies that more carefully adjust for other regional factors, such as the cost of living, find no evidence that market concentration per se is associated with lower wages (Adamache and Sloan 1982; Feldman and Scheffler 1982; Hirsch and Schumacher 1995). Hirsch and Schumacher (2005) find some evidence among women that wages are lower in markets with lower worker mobility, but not for RNs.

A more recent approach has sought to explicitly estimate the elasticity or inverse elasticity of labor supply to an individual hospital. In a simple static model of monopsony, the inverse elasticity of labor supply is a measure of "exploitation" analogous to the Lerner index and equals the percentage amount that the wage lies below marginal revenue product (see Boal and Ransom 1997). Sullivan (1989) estimated a wage elasticity of supply to individual hospitals of 1.26 over a 1-year period and 3.85 over a 3-year period, using a national sample of hospitals from 1980 to 1985. In contrast, Hansen (1992), using an almost identical methodology, found that supply was very elastic in California from 1980 to 1987. Hansen's estimates of the labor supply elasticity ranged from 29 to 56.[2] In a dynamic model, these short-run elasticity estimates will overstate the amount of exploitation if labor supply is more elastic in the long run. Under reasonable assumptions, even Sullivan's estimates suggest that monopsony power is small in this market, with RN wages no more than 10% below marginal revenue product (Boal and Ransom 1997).

There are two reasons to believe that these estimates may overstate the short-run supply elasticity (and thereby understate the amount of monopsony power). First, in both papers, hospital days are assumed to be exogenous demand shifters and serve as instruments in estimating the supply curve by two-stage least squares (2SLS). Therefore, these papers' 2SLS estimates of elasticities greater than 1 reflect the fact that for a given decline in hospital days, we observed RN employment to fall by more (often much more) than RN wages. However, reimbursement of hospitals

[2] Matsudaira (2009) finds a highly elastic labor supply of nurse aides, using changes in minimum staffing rules in California as an instrument for demand. Unfortunately, the staffing rules had little impact on higher-skilled nurses and could not be used to accurately estimate labor supply elasticities for RNs.

changed dramatically over this period with the introduction of Medicare's Prospective Payment System in 1984, and hospitals responded to this change by reducing days spent in the hospital (Coulam and Gaumer 1991). This suggests that much of the observed variation in hospital days over the early 1980s was endogenous. If hospital days were chosen endogenously, one would expect a positive association between the error in the supply equation and hospital days. This would bias the 2SLS method toward overstating the positive relationship between hospital days and RN employment and would therefore bias upward the estimate of the elasticity of supply.

A second reason to believe that these estimates may overstate the short-run supply elasticity is that both studies measure the wage using the average RN wage in the hospital. If a wage increase results in disproportionate hiring at the entry level, and entry-level workers are paid less, then the change in the average wage will tend to understate the actual change in the wage (because of the shift toward entry-level workers). As a result, estimates of the labor supply elasticity will be biased upward (Boal and Ransom 1997, n. 25).

## III. RN Wages and VA Policy

In 1991, the VA went from paying RN wages based on a national scale to a system that set RN wages based on a local wage survey. This legislated change in RN wages at VA hospitals provides an ideal opportunity to examine whether there is monopsonistic competition in the RN labor market while avoiding many of the problems of the previous literature. A short panel of data is available for VA and non-VA hospitals with complete information on staffing levels, patient caseloads, wages (including starting wages), and other hospital characteristics. The data can be first-differenced to control for variation in the cost of living and unmeasured attributes of hospitals. Finally, no assumptions need to be made about exogenous demand shocks, since the legislation generates exogenous changes in wages at VA hospitals, and these changes can in turn be used to construct instruments for wage changes at competing non-VA hospitals.

Prior to 1991, the VA set RN wages in all of its hospitals according to a national pay scale, with only minor adjustments to wages in hospitals in high-wage markets. This policy seriously affected the VA's ability to recruit and retain RNs for two reasons. First, VA wages tended to lag behind the market throughout the 1980s as real wages of RNs rose rapidly (Buerhaus and Staiger 1996). More important, this policy caused VA wages to diverge from those of local labor markets, because nurse wages vary widely across regions. VA hospitals could respond somewhat to market conditions by obtaining waivers for wage increases from the VA central office. Although the waiver system improved the ability of VA hospitals

to match market wages, the waivers were constrained by VA budgets and were often granted after local wages had risen further. For example, based on data from 1990 (see Sec. V below), starting RN wages in Milwaukee—a relatively low-wage market—averaged $11.20 per hour at non-VA hospitals, while the VA starting wage was competitive at $11.65 per hour. However, in San Francisco—a relatively high-wage market—the VA wage lagged well behind the market, with non-VA hospitals paying an average hourly wage of $16.30 and local VA hospitals paying only $14.00.

The VA sought to remedy this problem with the passage of the Nurse Pay Act of 1990, which changed how the VA set wages for RNs, effective April 7, 1991 (Department of Veterans Affairs 1991). This law tied RN wages at each VA hospital to those that prevailed in its local labor market, with market wages determined by an annual survey of other hospitals in each VA hospital's region.[3] As a result, wage scales of RNs were immediately raised to match the market in the roughly two-thirds of VA hospitals that had been paying below the prevailing market wage.[4] At the remaining VA hospitals that were paying above-market wages, wages were held constant in nominal terms until they came in line with the prevailing market wage. Thus the law generated an exogenous change in RN wages at VA hospitals, with the magnitude of the wage change varying across hospitals.

The local wage surveys determined wages in four broad pay grades (defined by qualifications and experience), so that entry wages and wages of more experienced RNs were affected differently. The VA reported that wages increased more for entry-level RNs following the Nurse Pay Act, leading to pay compression within the VA (U.S. General Accounting Office 1992). Our data were restricted to entry-level wages and therefore may overstate the wage change at the VA (in contrast to the usual approach of using average wages, which tends to understate the wage change).

In addition to mandating wage changes, the Nurse Pay Act of 1990 provided each VA hospital with additional funds in its budget to finance its increased wage bills (including any new hires to fill existing vacancies) without reducing other expenditures. As a result, individual VA hospitals that had their wages raised by the act were free to hire additional RNs up to previously determined staffing needs, with the costs being passed on to the central office. During the study period, staffing needs were well

[3] The local market for each VA hospital was defined as the Consolidated Metropolitan Statistical Area (CMSA) or Metropolitan Statistical Area (MSA) in which the VA hospital was located. The 27 VA hospitals in rural areas were allowed to determine their local competitors within reasonable limits. If there were 15 or fewer non-VA hospitals in the local market, all hospitals were surveyed. If there were more than 15 other hospitals, the survey was based on a sample of the other hospitals.

[4] These figures are computed from the data discussed below.

above pre–Nurse Pay Act staffing levels for nearly all VA hospitals. Staffing needs (and the associated budget) for each VA hospital were allocated to units based on workload (inpatient plus outpatient visits, adjusted for the types of visits), and there was limited ability within units to substitute lower-skilled personnel (e.g., aides) for RNs. Thus, each unit was allocated a fixed number of nursing full-time equivalents (FTEs), and there was little discretion. Because RN wages at the VA hospitals were below wages at other hospitals (particularly in high-wage areas), the VA hospitals had difficulty filling these positions, resulting in high vacancy rates prior to the Nurse Pay Act (U.S. General Accounting Office 1992).

In summary, the Nurse Pay Act of 1990 provides a unique opportunity to examine the extent of monopsony power in the nurse labor market. We can estimate the elasticity of supply of RNs to individual hospitals based on a legislated change in the wage, unrelated to changes in supply shocks, at VA hospitals in which labor demand was not binding. Moreover, we can learn to what extent hospitals have wage-setting power by observing whether non-VA hospitals adjusted their wages in response to the change in VA wages.

## IV. Theoretical Model

Consider a general model of monopsony in which firms face a labor supply curve that is upward sloping in their own wage and downward sloping in the wage of competitors:

$$L_i = f(w_1, w_2, \dots, w_k), \text{ where } \frac{\partial L_i}{\partial w_i} > 0,\ \frac{\partial L_i}{\partial w_j} < 0 \text{ for } i \neq j,\ i = 0, \dots, k. \tag{1}$$

A profit-maximizing firm will set wages to maximize $R(L_i) - L_i \times w_i$, where $R(.)$ is the firm's revenue function, $L_i$ is the firm's employment, and $w_i$ is the firm's wage. The first-order condition for this problem implies:

$$\frac{\text{MRP} - w}{w} = \varepsilon^{-1}, \tag{2}$$

where MRP is the marginal revenue product of labor and $\epsilon$ is the own-wage elasticity of labor supply. Thus, the own-wage elasticity of labor supply is the key to measuring monopsony power and summarizes the extent to which a firm may reduce wages below MRP.

To guide our empirical work, we consider a simplified version of equation (1). Our model is an application of Salop's (1979) model of competition around a circle. We assume RNs are distributed uniformly around a circle, and they choose to work at one of $N$ hospitals. Given our focus

on short-run labor supply, we ignore the issue of hospital entry and exit and treat $N$ as fixed.[5] Hospitals are located equidistantly around the circle, with the distance between hospitals (and the number of nurses located between hospitals) equal to $\alpha$. A nurse located between two hospitals will choose to work at the hospital at which the wage, net of travel costs, is highest. Letting $\tau$ represent the travel costs per unit distance, it is straightforward to derive the labor supply facing a given hospital as a function of its own wage and the wage of its nearest competitors:

$$L_i = \alpha + \frac{1}{\tau}\left(w_i - \frac{w_{i-1} + w_{i+1}}{2}\right), \; i = 1, \ldots, N, \tag{3}$$

where $w_{i-1}$ and $w_{i+1}$ are wages at the two adjacent hospitals. Thus, the simple structure of competition along a circle yields a labor supply equation that depends only on the gap between a hospital's wage and the average wage of its two nearest competitors. Total labor supply to the market is assumed fixed (e.g., a doubling of all wages does not affect the labor supply to any individual hospital).

Wages at the VA are set exogenously by federal policy, but wages at all other hospitals are assumed to be set endogenously. If the marginal benefit to a hospital of employing a nurse is $\beta$, we assume that hospitals set wages to maximize the total net benefits derived from RNs; that is, they choose $w$ to maximize $L(\beta - w)$. The first-order condition for this maximization problem provides the wage-setting equation (i.e., labor demand) for the model:

$$w_i = \beta - \tau L_i. \tag{4}$$

Thus, wages are set below MRP, and the size of the wage markdown depends on the slope of the labor supply equation (3).

Equations (3) and (4) provide the structural equations for the model. The labor supply equation (3) cannot be estimated by ordinary least squares (OLS), since wages are set endogenously according to equation (4). Estimation of the labor supply equation requires valid instruments—that is, variables that are correlated with wages but not correlated with the error in the labor supply equation ($\alpha$). If one hospital in the market (the VA hospital) sets the wage independently of $\alpha$, then that wage can serve as an instrument since it will affect the wages at all other hospitals in the market.

It is relatively straightforward to solve this model of competition on a circle and derive the reduced-form equation for each hospital's equilibrium wage. Note that this reduced-form equation is important in that it

[5] The 1992 American Hospital Association survey discussed below has about 1% fewer observations than the 1990 data. Thus, the assumption that the number of hospitals is constant does not seem overly restrictive.

serves as the first-stage equation in estimating labor supply. In the standard model of competition on a circle, all hospitals would be identical, and the solution would be a symmetric wage equilibrium with $w^* = \beta - \alpha\tau$. Our model is not symmetric, since the VA hospital differs from all non-VA hospitals in that its wage is set exogenously. Therefore, the equilibrium is asymmetric with equilibrium wages at non-VA hospitals depending on the distance between each hospital and the VA hospital. Distance ($d$) is measured by the number of hospitals located between a given hospital and the VA hospital (e.g., $d = 0$ for the two hospitals located adjacent to the VA hospital).

If there is only one VA hospital setting wages exogenously in each market, then (after some algebra) equilibrium wages at non-VA hospitals can be shown to be a weighted average of the VA wage ($w^{VA}$) and the symmetric equilibrium wage ($w^*$):

$$w_i = (1 - \theta_i)w^* + \theta_i w^{VA}. \tag{5}$$

The weight placed on the VA wage ($\theta_i$) captures the effect of the VA wage on wages at non-VA hospitals and depends only on the number of hospitals ($N$) in the market and each hospital's distance from the VA ($d$). It is straightforward to derive three useful properties of $\theta_i$ in this model. First, $\theta_i$ is between 0 and 1/2, which implies that non-VA hospitals will respond partially to VA wage changes. Furthermore, $\theta_i$ decreases with distance from the VA hospital ($\partial\theta_i/\partial d < 0$), as one would expect if hospitals are differentiated by location. Finally, $\theta_i$ decreases with the number of competitors on the circle ($\partial\theta_i/\partial N < 0$), suggesting that non-VA hospitals will respond less to VA wage changes when the VA has a smaller share of the market.

This simple model of the RN labor market is useful for two reasons. First, the model has empirical implications. Structural labor supply to a particular hospital depends only on the wage gap between a given hospital and its nearest neighbors, increasing with the wage paid by that hospital and decreasing with the wage paid by nearby hospitals. Furthermore, wages at non-VA hospitals are positively related to VA wage changes, with the strongest effect of VA wages at hospitals located near the VA and with few competitors. The second reason that the model is useful is that it demonstrates how changes in VA wages can be used to identify the labor supply equation. Changes in VA wages provide a natural instrument for identifying the labor supply equation, since these changes are arguably exogenous and affect wages at all hospitals either directly (at VA hospitals) or indirectly (at non-VA hospitals through eq. [5]).

## V. Data

The data used in this study are obtained from several publicly available sources and from the VA's records. The unit of observation for our anal-

ysis is a hospital. Our primary sources of information about nurse wages and employment in non-VA hospitals are the American Hospital Association (AHA) Nursing Personnel Surveys (NPS) of 1990 and 1992. Thus, we have 1 year of data prior to the Nurse Pay Act (1990) and 1 year of data that was entirely postimplementation (1992). Unfortunately, data are not available from the NPS after 1992.

The 1990 NPS surveyed all hospitals in the United States, while the 1992 data are limited to nonfederal facilities. This survey collects detailed information about RN employment and wages, along with a wide variety of additional information such as budgeted positions, the mix of nursing staff (RNs, licensed practical nurses, etc.), tenure, education, vacancy and turnover rates, work schedules, collective bargaining, and temporary and foreign nurse utilization. The NPS was used to obtain wages for non-VA hospitals, to calculate market wages faced by all hospitals, and to provide background information about each hospital. In 1992, less than half of the hospitals surveyed responded to questions about wages and employment levels, limiting our sample size significantly.

The AHA Annual Survey of Hospitals provides additional data on hospital characteristics for VA and non-VA facilities and is available in 1990 and 1992 for most hospitals in the United States. These surveys include a wide range of information about general hospital characteristics and provided us with information on hospital location. The AHA survey also includes some data about nurse staffing, which were used to check the validity of the NPS.

The VA Personnel and Accounting Integrated Data (PAID) system, salary surveys conducted for the locality pay system, and published VA data on employment levels of nurses provide most of our information on VA hospitals, since federal hospitals did not respond to the NPS in 1992. The VA's Centralized Accounting for Local Management (CALM) system 830 file contains facility-level information on the aggregate number of RNs on staff (FTE) and their average salary. The VA PAID system data file is used to measure starting wages for RNs at VA hospitals. The personnel office at the VA's central office provided copies of the Nurse Pay Act RN pay schedules for each VA medical center and copies of the wage surveys. These provide additional data on the changes in RN wages at VA hospitals and wages at hospitals that compete with the VA hospitals. We also used these data to check the accuracy of the NPS data in 1990.

Cross-checks of the different data reveal little inconsistency in our measures of wages, employment levels, and hospital characteristics. This alleviates any concern arising from the fact that the NPS and AHA data are based on hospital responses to surveys. Similarly, the VA accounting data should be of high quality, since they are from an internal accounting system instead of survey responses. While it is likely that some mea-

surement error exists in our data, we do not believe that it is sufficiently large to bias the results of this study.

The employment of RNs is measured as the FTE employment of RNs in each hospital for which we have data. Wages are the lowest hourly wage reported by the hospital. We selected the lowest hourly wage for our wage measure for two reasons. First, the lowest wage will apply to entry-level nurses with basic education and no experience. Thus, changes in this wage measure will not be biased by differences across hospitals or over time in average RN characteristics such as tenure or experience. Second, one might argue that labor supply is particularly sensitive to entry-level wages, because hospitals often offer nonpecuniary benefits to retain more senior RNs, such as more choice of shifts.

Based on the latitude and longitude centroid for the zip code of each hospital, we calculated the distance from each hospital to the nearest VA hospital. Our final sample is limited to hospitals that are within 60 miles of a VA hospital, and our empirical work distinguishes hospitals that are more than 15 miles and more than 30 miles from a VA hospital.[6] Similarly, for each hospital we calculated the number of other short-term general hospitals (from the AHA Annual Survey of Hospitals) within a 15-mile radius. Finally, we used similar distance calculations to identify the two nearest competitors for each hospital. The wage at each hospital's two nearest competitors is defined as the average log wage of the two hospitals nearest to the hospital in question that report wages in both 1990 and 1992.

To some extent, each VA may have had some influence over the wage change it experienced between 1990 and 1992 through discretion over which hospitals to include in the wage survey. This would raise doubt about the exogeneity of the VA wage changes. An alternative measure of the change imposed on VA hospitals by the Nurse Pay Act is the gap between market wages and VA wages in 1990, prior to the Nurse Pay Act's implementation. This 1990 wage gap is not influenced by the VA's actions following the act, yet it will measure the impact that the Nurse Pay Act should have had on a VA hospital's wages.

For each VA hospital, we calculated the gap between the VA wage and its market's wage in 1990 as the difference between the average log wage in each VA hospital's market area (weighted by hospital beds) and the VA log wage. The VA market area is defined as either the Consolidated Metropolitan Statistical Area (CMSA) or the Metropolitan Statistical Area (MSA; if a CMSA does not exist); for rural hospitals, the market area includes all other rural hospitals in the state. As can be seen in figure 1, the difference between the market wage and the VA wage in 1990 was a strong predictor of the change in the VA wage from 1990 to 1992. Finally,

[6] Our results are not sensitive to the 60-mile limit in our sample.

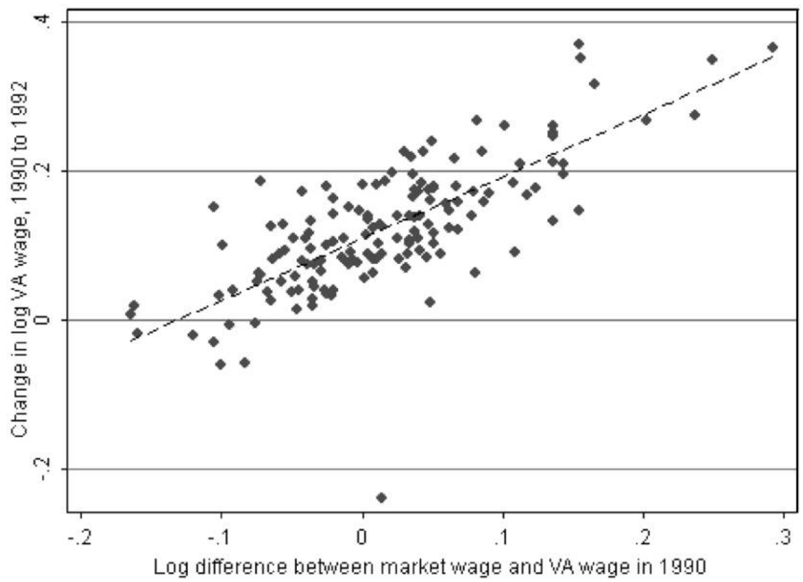


FIG. 1.—Difference between the market wage and the VA wage in 1990 and its association with the change in the VA wage from 1990 to 1992. Each point represents data for a single VA hospital in our sample, with the simple regression line for these data also displayed.

to control for differences in the cost of living and local labor market conditions, we construct dummy variables for the CMSA/MSA in which each hospital is located and, for rural hospitals, dummy variables for the remainder of the state.

Table 1 presents selected summary statistics for all hospitals, for VA hospitals, and for non-VA hospitals. In 1990, just under 60% of VA hospitals paid wages that were below market, with the average VA hospital paying 1.9% below market. There was considerable variation in the wage gap across VA hospitals. The Nurse Pay Act brought VA wages up to the market level in 1992. As a result, VA wages increased more between 1990 and 1992 (12.5%) than did wages at non-VA hospitals (9.9%), and the variation in wage growth was larger at VA hospitals as well. Growth in employment also was more rapid at VA hospitals, with RN FTEs increasing by 8.3% as compared to 5.6% in non-VA hospitals. Thus, VA wages increased by 2.6% more than non-VA wages following the Nurse Pay Act, and VA employment increased by 2.7% more than non-VA employment. These estimates suggest a labor supply elasticity of around 1, although the standard error on this simple Wald estimate is over 0.7.

The remaining variables in table 1 describe the ownership and location of the hospitals in our sample. Just over 10% of the sample is VA hospitals. Non-VA hospitals are, on average, 23 miles from the nearest VA, with

**Table 1**
**Summary Statistics for RN Wages and Employment, 1990–92**

| | All | VA | Non-VA |
|---|---|---|---|
| Wage gap at nearest VA in 1990 (log(market wage) − log(VA wage)) | .013 | .019 | .012 |
| | (.081) | (.079) | (.081) |
| Nearest VA wage below market in 1990? | 53.0% | 58.7% | 50.0% |
| Change in log wage (1990–92) | .102 | .125 | .099 |
| | (.073) | (.088) | (.070) |
| Change in log wage (1990–92) at nearest VA | .122 | .125 | .122 |
| | (.093) | (.088) | (.094) |
| Change in average log wage (1990–92) at two nearest competitors | .102 | .101 | .102 |
| | (.056) | (.058) | (.056) |
| Change in RN full-time equivalents (1990–92) | .059 | .083 | .056 |
| | (.212) | (.088) | (.223) |
| VA hospital? | 11.6% | 100% | 0% |
| Distance to nearest VA (miles) | 20.3 | 0 | 23.0 |
| | (18.2) | (0) | (17.7) |
| More than 15 miles to nearest VA? | 50.4% | 0% | 57.0% |
| More than 30 miles to nearest VA? | 30.4% | 0% | 34.4% |
| No. of hospitals within 15 miles | 11.6 | 10.9 | 11.7 |
| | (17.3) | (15.6) | (17.5) |
| No. of observations in sample | 1,334 | 155 | 1,179 |

Note.—Values are means, and standard deviations are in parentheses.

over half of the sample more than 15 miles from the nearest VA and about one-third more than 30 miles. On average, both VA and non-VA hospitals have more than 10 competitors within a 15-mile radius, although there is significant variation in the number of competitors.

## VI. Empirical Analysis

### A. Reduced-Form Wage Equations for Non-VA Hospitals

We examine the effect of the VA's wage changes on wages at other hospitals by estimating the reduced-form wage equation (5) in differenced form:

$$\Delta(\ln w_i) = \alpha_0 + \alpha_1 \Delta(\ln w_i^{\mathrm{VA}}) + \alpha_2 \mathrm{D15}_i \Delta(\ln w_i^{\mathrm{VA}}) + \alpha_3 \mathrm{D30}_i \Delta(\ln w_i^{\mathrm{VA}}) + \varepsilon_i, \tag{6}$$

where $w_i$ is the wage at a non-VA hospital, $w_i^{\mathrm{VA}}$ is the wage at the nearest VA hospital to hospital $i$, and $\mathrm{D15}_i$ and $\mathrm{D30}_i$ are dummy variables that equal 1 if hospital $i$ is more than 15 miles or more than 30 miles, respectively, from a VA hospital. We take the difference of each variable between 1990 and 1992 to control for hospital characteristics that are constant over time. As discussed above, we expect $\alpha_1 > 0$ and $\alpha_2, \alpha_3 < 0$; that is, the change in the VA wage should have a positive effect on the wage change in other hospitals, but this effect should decline in magnitude as hospitals are farther from the VA hospital.

**Table 2**
**Reduced-Form Estimates of the Impact of VA Wage Changes on the Wage Changes in Non-VA Hospitals, 1990–92**

| Independent Variable | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| Change in log wage of RNs at the nearest VA (1990–92) | .128 | .178 | .137 | .190 |
| | (.033) | (.043) | (.077) | (.106) |
| Change in log wage of RNs at the nearest VA (1990–92) × dummy if > 15 miles to VA | | −.078 | −.105 | −.139 |
| | | (.040) | (.042) | (.082) |
| Change in log wage of RNs at the nearest VA (1990–92) × dummy if > 30 miles to VA | | −.049 | −.035 | −.100 |
| | | (.037) | (.056) | (.098) |
| Dummy if > 15 miles to VA | | | | .008 |
| | | | | (.012) |
| Dummy if > 30 miles to VA | | | | .013 |
| | | | | (.014) |
| MSA dummies? | No | No | Yes | Yes |
| $R^2$ | .029 | .044 | .274 | .276 |
| No. of observations | 1,179 | 1,179 | 1,179 | 1,179 |

NOTE.—Standard errors are in parentheses, clustered at the Metropolitan Statistical Area (MSA) level. Sample includes all non-VA hospitals within 60 miles of a VA hospital. Based on data from the American Hospital Association's Annual Survey of Hospitals and the Nursing Personnel Survey, 1990 and 1992, augmented with wage and employment information for VA hospitals from VA administrative data. All wages refer to starting (lowest) wages of RNs. Dependent variable = ln(wage92) − ln(wage90).

Estimates of equation (6) are presented in table 2. The dependent variable in all the regressions is the change in the log wage of RNs at non-VA hospitals. Several variations of this equation were estimated. The first column includes only the change in the log wage at the nearest VA hospital. The second column presents interactions between the VA wage change and two dummy variables: one for whether the hospital is more than 15 miles from a VA hospital and another for whether there is more than a 30-mile distance. The third column adds MSA dummy variables to allow for area-specific trends in wages. Finally, the fourth column adds dummy variables for being more than 15 and 30 miles from a VA hospital. Standard errors for these and all subsequent regression estimates account for clustering at the MSA level.

The results for all specifications are consistent with the theory. The VA wage change has a positive and significant effect on wages at neighboring hospitals, but this effect is significantly smaller (about half the magnitude) in hospitals that are 15–30 miles from a VA hospital and disappears almost entirely for hospitals more than 30 miles from a VA hospital. For example, in the first column we estimate that the elasticity of wages at non-VA hospitals with respect to the VA wage is 0.128—that is, a 1.28% increase in response to a 10% increase in the wage at the nearest VA hospital. In the second column we allow the effect of the VA wage to vary with the distance to the VA hospital. The estimated elasticity increases to 0.178

**Table 3**
**Reduced-Form Estimates of the Impact of the VA Wage Gap in 1990 on the Wage Changes in VA and Non-VA Hospitals, 1990–92**

| Independent Variables | VA Only (1) | Non-VA Only (2) | Non-VA Only (3) | Non-VA Only (4) | Non-VA Only (5) |
|---|---|---|---|---|---|
| Wage gap at nearest VA in 1990 (log (market wage) − log (VA wage)) | .830 | .090 | .161 | .345 | .344 |
| | (.055) | (.034) | (.061) | (.067) | (.065) |
| Wage gap at nearest VA in 1990 × dummy if > 15 miles to VA | | | −.109 | −.154 | −.146 |
| | | | (.075) | (.072) | (.071) |
| Wage gap at nearest VA in 1990 × dummy if > 30 miles to VA | | | −.033 | −.112 | −.120 |
| | | | (.064) | (.091) | (.091) |
| Dummy if > 15 miles to VA | | | | | −.008 |
| | | | | | (.006) |
| Dummy if > 30 miles to VA | | | | | .000 |
| | | | | | (.008) |
| MSA dummies? | No | No | No | Yes | Yes |
| $R^2$ | .559 | .011 | .017 | .281 | .282 |
| No. of observations | 155 | 1,179 | 1,179 | 1,179 | 1,179 |

Note.—Standard errors are in parentheses, clustered at the Metropolitan Statistical Area (MSA) level. Sample includes all non-VA hospitals within 60 miles of a VA hospital. Based on data from the American Hospital Association's Annual Survey of Hospitals and the Nursing Personnel Survey, 1990 and 1992, augmented with wage and employment information for VA hospitals from VA administrative data. All wages refer to starting (lowest) wages of RNs. The market wage is calculated as the average starting wage in 1990 among hospitals in each VA hospital's market. The market wage is a weighted average, using the number of hospital beds as weights. Markets are Consolidated Metropolitan Statistical Areas (CMSAs), MSAs for hospitals not in a CMSA, and states for hospitals not in an MSA or CMSA. Dependent variable = ln (wage92) − ln (wage90).

for hospitals within 15 miles of a VA hospital (the reference group) but is significantly lower for hospitals 15–30 miles from the VA (0.100) and lower still for hospitals more than 30 miles from the VA (0.051).[7] Results for the remaining specifications are quite similar.

Changes in the VA wage were not entirely determined by the law since VA hospitals had some discretion in determining which hospitals to survey in setting 1992 wages. Thus, some of the positive correlation between VA wage growth and wage growth at nearby hospitals may reflect the VA's response to wages at other hospitals. The gap between the market wage and the VA wage in 1990 is used in table 3 as a proxy that predicts the wage growth that resulted from the Nurse Pay Act. This wage gap in 1990 is not influenced by the VA's later actions. The first column of table 3 estimates the relationship between this proxy and actual wage growth between 1990 and 1992 at the VA hospitals. There is a very strong re-

[7] Note that eq. (6) is specified so that the effects are cumulative; e.g., the effect of the VA wage on wages at hospitals more than 30 miles away is 0.178 − 0.078 − 0.049 = 0.051.

**Table 4**
**Reduced-Form Estimates of the Impact of VA Wage Changes on the Wage Changes in Non-VA Hospitals, 1990–92, for Alternative Samples of Hospitals**

| Independent Variables | < 5 Competitors within 15 Miles (1) | ≥ 5 Competitors within 15 Miles (2) | Positive Wage Gap at Nearest VA (3) | Negative Wage Gap at Nearest VA (4) |
|---|---|---|---|---|
| Wage gap at nearest VA in 1990 | .348 | .403 | .558 | .127 |
| | (.202) | (.035) | (.205) | (.245) |
| Wage gap at nearest VA in 1990 × dummy if > 15 miles to VA | −.168 | −.199 | −.179 | .030 |
| | (.208) | (.125) | (.098) | (.124) |
| Wage gap at nearest VA in 1990 × dummy if > 30 miles to VA | −.155 | .162 | −.184 | −.021 |
| | (.107) | (.204) | (.140) | (.178) |
| MSA dummies? | Yes | Yes | Yes | Yes |
| $R^2$ | .366 | .260 | .343 | .240 |
| No. of observations | 612 | 567 | 616 | 563 |

NOTE.—Standard errors are in parentheses, clustered at the Metropolitan Statistical Area (MSA) level. Sample includes all non-VA hospitals within 60 miles of a VA hospital. Based on data from the American Hospital Association's Annual Survey of Hospitals and the Nursing Personnel Survey, 1990 and 1992, augmented with wage and employment information for VA hospitals from VA administrative data. All wages refer to starting (lowest) wages of RNs. Dependent variable = ln(wage92) − ln(wage90).

lationship between the wage gap that existed for each VA in 1990 and each VA's subsequent wage growth, with a precisely estimated coefficient on the wage gap that is near 1 and an $R^2$ on this simple regression of just over 0.5.

The remaining columns of table 3 (cols. 2–5) estimate the same specifications as in table 2 for non-VA hospitals, using the wage gap from 1990 in place of actual wage growth at the nearest VA. The results are quite similar to those of table 2 (although the estimated elasticities are noticeably larger when MSA dummies are included). In particular, the wage gap has a positive, statistically significant effect on wage growth at non-VAs, and this effect is smaller at hospitals that are further from the VA.

The first two columns of table 4 investigate whether the effect of the VA wage change on other hospitals' wage growth is larger in markets with fewer competitors, as suggested by our simple model. The first column limits the sample to hospitals that had fewer than five competitors within 15 miles, and the second column limits the sample to hospitals with five or more competitors within 15 miles. Each regression includes the VA wage gap in 1990, this gap interacted with dummy variables for being more than 15 miles and more than 30 miles from a VA hospital,

and MSA dummy variables. The point estimates indicate that changes in the VA wage has similar effects on hospitals in competitive markets to those in less competitive markets. These results provide no evidence that a wage change at an individual hospital is less important when there are more hospitals in the market. However, the standard errors on these estimates are quite large, so the power of this test is obviously low.

When the VA implemented the Nurse Pay Act, it did not change nominal wages at hospitals that paid higher wages than the market. Thus, we should not observe a response by non-VA hospitals to the 1990 VA wage gap if the gap is negative because the negative gap was not correlated with the actual wage change at the VA. Columns 3 and 4 of table 4 examine this possibility. Column 3 presents the coefficients of an equation for non-VA hospitals with a positive wage gap at the nearest VA hospital (i.e., the VA wage is lower than the market wage). As expected, the VA wage change has a large, statistically significant effect on non-VA hospitals' wages. Column 4 presents the same equation for hospitals for which the VA wage gap is negative. Where the VA medical center paid more than the market and thus did not change its wages with the Nurse Pay Act, the VA wage gap has no effect on the wages of other hospitals.

### B. Labor Supply Equations for All Hospitals

We estimate the labor supply equation (3) in a first-difference form to measure the elasticity of supply of RNs:

$$\Delta(\ln L_i) = \theta_0 + \theta_1 \Delta(\ln w_i - \ln w_j) + \mu_i, \tag{7}$$

where $L_i$ is the number of RN FTEs employed at hospital $i$ (for VA hospitals and other hospitals), $w_i$ is the wage at hospital $i$, $\ln w_j$ is the average log wage at hospital $i$'s two nearest competitors, and $\theta_1$ is the elasticity of supply of RNs to an individual hospital. We found evidence of heteroskedasticity in the error and therefore weight all regressions by the number of beds at the hospital in 1990.

As discussed earlier, OLS estimates of equation (7) are biased. We estimate equation (7) using two-stage least squares. The VA wage change mandated by the Nurse Pay Act provides the instrument for the change in the log wage gap $\Delta(\ln w_i - \ln w_j)$. We take care in specifying the first-stage equation. According to theory, the impact of the VA wage change on $\Delta(\ln w_i - \ln w_j)$ depends on whether the hospital and its nearest neighbors are VA hospitals and, if not, which VA hospital the hospital is closest to and how far it is from that VA hospital. The estimates in tables 2–4

**Table 5**
**Two-Stage Least Squares Estimates of RN Labor Supply Elasticities**

| Independent Variables | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| Change in the log wage gap between hospital and its two nearest competitors | .076 | .080 | .016 | .185 | .185 | .127 |
| | (.137) | (.133) | (.177) | (.138) | (.135) | (.185) |
| Dummy if VA hospital | | | .023 | | | .019 |
| | | | (.014) | | | (.014) |
| MSA dummies? | No | No | Yes | No | No | Yes |
| "FAR" instruments included? | No | Yes | Yes | No | Yes | Yes |
| "GAP" instruments used? | No | No | No | Yes | Yes | Yes |
| *p*-value for test of the over-identifying restrictions | .71 | .45 | .31 | .20 | .20 | .12 |
| No. of observations | 1,334 | 1,334 | 1,334 | 1,334 | 1,334 | 1,334 |

NOTE.—Standard errors are in parentheses, clustered at the Metropolitan Statistical Area (MSA) level. Sample includes all non-VA hospitals within 60 miles of a VA hospital. All regressions are weighted by the number of hospital beds in 1990. All wages refer to starting (lowest) wages of RNs. Change in the log wage gap between a hospital and its two nearest competitors is defined as [ln(wage92) − ln(wage90)] − [ln(compwage92) − ln(compwage90)], where compwage90 and compwage 92 are as defined in table A1. Specifications with "FAR" instruments use first-stage regressions given in cols. 2, 3, 5, and 6 of table A1. Specifications using "GAP" instruments use first-stage regressions given in cols. 4–6 of table A1. Dependent variable = ln(RN FTEs, 1992) − ln(RN FTEs, 1990).

suggest that the wage growth in any given hospital should be specified as:

$$\Delta \ln w_i = \pi_0 + \text{DVA}_i(\pi_1 + \pi_2 \Delta \ln w_i^{\text{VA}}) + (1 - \text{DVA}_i) \times (\pi_3 \Delta \ln w_i^{\text{VA}} + \pi_4 \text{D15} + \pi_5 \text{D30} + \pi_6 \text{D15} \Delta \ln w_i^{\text{VA}} + \pi_7 \text{D30} \pi \ln w_i^{\text{VA}}), \tag{8}$$

where DVA is an indicator for being a VA hospital. In the first-stage equation, we wish to estimate the difference in wage growth between a hospital and its two nearest neighbors. Therefore, the appropriate specification for the first stage includes the differences between the hospital and each of its two nearest neighbors. Table A1 in the appendix provides estimates of the first-stage equations for various specifications. The coefficients are generally as expected, and *F*-tests indicate that the instruments are strongly correlated with the change in the wage gap.

Estimates of labor supply elasticities from two-stage least squares estimates of equation (7) are given in table 5. The first three columns construct the instruments using the actual wage change at the VA. The first specification does not include the instruments that rely on distance from a VA hospital, while the second specification adds these instruments. Column 3 adds MSA dummies and a dummy for being a VA hospital to the supply equation. The MSA dummies capture local factors (such as alternative wages) that may influence supply, while the VA dummy captures any common change at the VA hospital that may have made em-

**Table 6**
**Two-Stage Least Squares Estimates of RN Labor Supply Elasticities Allowing Separate Effects of Own Wage and Competitor's Wage**

| Independent Variables | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| Change in own log wage | .083 | .120 | .046 | .199 | .232 | .183 |
| | (.128) | (.124) | (.182) | (.128) | (.127) | (.213) |
| Change in log wage at two nearest competitors | −.006 | −.048 | .074 | −.116 | −.061 | −.028 |
| | (.261) | (.244) | (.453) | (.292) | (.281) | (.393) |
| Dummy if VA hospital | | | .023 | | | .017 |
| | | | (.015) | | | (.014) |
| MSA dummies? | No | No | Yes | No | No | Yes |
| "FAR" instruments included? | No | Yes | Yes | No | Yes | Yes |
| "GAP" instruments used? | No | No | No | Yes | Yes | Yes |
| *p*-value for test of the over-identifying restrictions | .80 | .12 | .25 | .20 | .26 | .09 |
| No. of observations | 1,334 | 1,334 | 1,334 | 1,334 | 1,334 | 1,334 |

Note.—Standard errors are in parentheses, clustered at the Metropolitan Statistical Area (MSA) level. Sample includes all non-VA hospitals within 60 miles of a VA hospital. All regressions are weighted by the number of hospital beds in 1990. All wages refer to starting (lowest) wages of RNs. Change in log wage at two nearest competitors is [ln(compwage92) − ln(compwage90)], where compwage90 and compwage92 are as defined in table A1. Specifications with "FAR" instruments use the same instruments as in cols. 2, 3, 5, and 6 of table A1, plus the analogous set of variables for the hospital (e.g., not differenced from the competitor). Specifications using "GAP" instruments use the same instruments as in cols. 4–6 of table A1, plus the analogous set of variables for the hospital (e.g., not differenced from the competitor). Dependent variable = ln(RN FTEs, 1992) − ln(RN FTEs, 1990).

ployment more or less attractive at the VA hospital. The remaining three columns of table 5 repeat these specifications but construct the instruments using the wage gap at the VA hospital in 1990 as a proxy for the actual VA wage change (for reasons discussed earlier). For all specifications, we tested and could not reject the overidentifying restrictions; therefore, our instruments appear appropriate for our model.

The labor supply elasticities estimated in table 5 are reasonably consistent across specifications. The estimates range from 0 to 0.2, with standard errors of about 0.13 to 0.18. Thus, for the specifications in table 5, we estimate an inelastic short-run labor supply curve facing hospitals. Even the high end of the 95% confidence intervals for the labor supply elasticity does not go above 0.5. These estimates of labor supply elasticity are an order of magnitude smaller than those estimated by Sullivan (1989) and Hansen (1992).

Table 6 estimates specifications similar to those in table 5 but allows the change in the VA's own wage and the change in the nearest competitor's wage to have separate effects rather than constraining them to enter as a difference.[8] If the specifications of table 5 are correct, own wage

[8] For the specifications in table 6, we include own-wage growth and wage growth at the two nearest competitors separately and instrument for both. In those specifications, we add the undifferenced versions of the right-hand-side variables in eq. (6) to our instrument list. These added instruments can predict

**Table 7**
**Two-Stage Least Squares Estimates of RN Labor Supply Elasticities for Alternative Samples of Hospitals**

| Independent Variables | VA Only (1) | Non-VA Only (2) | < 5 Hospitals within 15 Miles (3) | ≥ 5 Hospitals within 15 Miles (4) | Positive Wage Gap at Nearest VA (5) |
|---|---|---|---|---|---|
| Change in the log wage gap between hospital and its two nearest competitors | .111 | −.073 | .590 | −.019 | .129 |
| | (.114) | (.267) | (.334) | (.190) | (.270) |
| Dummy if VA hospital | | | −.024 | .037 | .020 |
| | | | (.024) | (.016) | (.021) |
| MSA dummies? | No | Yes | Yes | Yes | Yes |
| "FAR" instruments included? | Yes | Yes | Yes | Yes | Yes |
| "GAP" instruments used? | Yes | Yes | Yes | Yes | Yes |
| *p*-value for test of the overidentifying restrictions | .58 | .35 | .02 | .75 | .34 |
| No. of observations | 155 | 1,179 | 685 | 649 | 707 |

NOTE.—Standard errors are in parentheses, clustered at the Metropolitan Statistical Area (MSA) level. Sample includes all non-VA hospitals within 60 miles of a VA hospital. All regressions are weighted by the number of hospital beds in 1990. All wages refer to starting (lowest) wages of RNs. Change in the log wage gap between a hospital and its two nearest competitors is defined as [ln(wage92) − ln(wage90)] − [ln(compwage92) − ln(compwage90)], where compwage90 and compwage92 are as defined in table A1. Specifications with "FAR" instruments use first-stage regressions given in cols. 2, 3, 5, and 6 of table A1. Specifications using "GAP" instruments use first-stage regressions given in cols. 4–6 of table A1. Dependent variable = ln(RN FTEs, 1992) − ln(RN FTEs, 1990).

and competitor's wage should enter with opposite-signed coefficients of the same magnitude. The coefficients are generally opposite signed, and the magnitudes are small, with elasticity estimates for these specifications remaining in the 0–0.2 range. The only exception is for the specification that includes MSA dummies and the actual change in the VA wage: for this specification, the effect of the change in log wage at the two nearest competitors is wrong signed and poorly identified.

Table 7 investigates the sensitivity of these estimates when the sample is restricted to (1) VA hospitals, (2) non-VA hospitals, (3) hospitals with fewer than five competitors within 15 miles, (4) hospitals with five or more competitors within 15 miles, and (5) hospitals for which the nearest VA had a positive wage gap. The basic conclusions are not particularly sensitive to these sample restrictions. All of the elasticity estimates remain small relative to the previous literature. There is more range in the elasticity estimates for these specifications (from −0.1 to 0.6), but this might

wage growth at a hospital, whereas the differenced versions can only predict the difference in wage growth between a hospital and its neighbors.

be expected given the relatively large standard errors for these specifications relative to those reported in table 5.

## VII. Discussion

Our analysis provides two pieces of evidence that suggest that hospitals have market power in the nurse labor market and have monopsony power in setting wages. First, we find that competing hospitals responded to legislated wage changes at the VA: a 10% increase in wages at the VA is estimated to have increased wages by 2% at hospitals within 15 miles and by roughly 1% at hospitals 15–30 miles from the VA hospital. Second, we find that the labor supply curve facing an individual hospital is very inelastic: a 10% increase in wages is estimated to increase labor supply by between 0% and 2%.

These results contradict much of the recent literature investigating monopsony, which has found little (if any) evidence of monopsony power in the labor market for nurses. In particular, our estimates of the labor supply elasticity are an order of magnitude below comparable estimates in the literature. This raises the question: why is this so?

One key difference between this study and others is in the instruments used to identify the supply elasticity. We rely on a legislated change in the wage at the VA as an instrument. Thus, our identification is similar to recent studies of the minimum wage, which also find that legislated changes in wages have small positive effects on employment (Card and Krueger 1995). Moreover, these legislated changes in wages are arguably ideal instruments for this problem because they come close to simulating the thought experiment that matters for labor supply: how will an exogenous increase in wages affect the VA's ability to attract nurses? The earlier literature used changes in caseload at the hospital as an instrument. As argued earlier, there are reasons to believe that caseload may not be a valid instrument and that the potential bias would be in the direction of overstating supply elasticities. However, it is possible that the VA adjusted nonwage margins (e.g., schedule flexibility) in ways that offset the legislated wage increase. If so, our elasticity estimates would be biased downward because the observed change in wages overstates the net change in wage plus nonwage compensation.

A second difference is our data. We have relied on starting wage data (rather than average wages), which avoids potential aggregation bias that may lead to downward bias in estimating wage changes (and hence an upward bias in estimating the supply elasticity). However, because the Nurse Pay Act may have increased starting wages more than other wages, our approach may have an upward bias in estimating wage changes (and hence a downward bias in estimating the supply elasticity). Another difference in our data is that we focus on the difference between a hospital's

wages and those of its nearest competitors, while the existing literature has generally measured competing wages as average wages at the county or MSA level. Finally, our estimates rely on data from 1990–92, while both Sullivan (1989) and Hansen (1992) use data from the early and mid-1980s, when dramatic changes in hospital reimbursement may have resulted in bias. While reimbursement rules were stable in our sample period, RN wages were growing rapidly prior to the Nurse Pay Act (Buerhaus and Staiger 1996), and it is possible that labor supply was less responsive to the current wage because of rapidly changing wages at all hospitals.

Apart from differences in our data and instruments, our focus on VA hospitals may be generating the difference in our findings. Our evidence of market power may be due to the fact that VA hospitals are highly differentiated workplaces (by being a federal employer and serving a unique cohort of patients). The supply of nurses might thus be segmented according to RNs' preferences for working or not working at VA facilities, reducing the response of labor supply to the change in the VA wage. Bhaskar and To (1999) and Manning (2003) suggest that this type of differentiation might produce monopsony power in other employment sectors. For example, within the fast-food or high-tech industries, workplaces are also highly differentiated in terms of corporate culture and customer base. Therefore, our results may be representative of the monopsony power exercised by many employers.

Our estimates of the short-run labor supply elasticity around 0.1 are quite low. If these were long-run elasticity estimates, they would imply that the marginal revenue product (MRP) of RNs was about 10 times their wage. However, common sense and most empirical studies (Sullivan 1989; Hansen 1992) suggest that long-run elasticities are considerably higher than short-run elasticities. Unfortunately, data were unavailable to examine longer-run supply elasticities.[9] However, if we assume that the long-run elasticity is infinite, then Boal and Ransom (1997) have shown that the amount of "exploitation"—the difference between MRP and the wage as a fraction of the wage—is given by the short-run inverse elasticity of supply multiplied by $r/(1 + r)$, where $r$ is the discount rate. Thus, for a discount rate of 5%, our elasticity estimates imply that the MRP of RNs was about 50% above their wages. This evidence, therefore, suggests that hospitals have considerable monopsony power.

[9] The last year of the NPS was 1992.

## Appendix

**Table A1**
**First-Stage Estimates Predicting the Change in the Wage Gap between a Hospital and Its Two Nearest Competitors, 1990–92**

| | Using the Actual Change in the Log Wage at the Nearest VA | | | Using the VA Log Wage Gap in 1990 as Proxy for Wage Change at the VA | | |
|---|---|---|---|---|---|---|
| Independent Variables | (1) | (2) | (3) | (4) | (5) | (6) |
| Difference between hospital and nearest competitor in: | | | | | | |
| (1) Dummy for VA hospital (DVA) | −.020 | −.018 | −.017 | .014 | .016 | .022 |
| | (.007) | (.007) | (.010) | (.005) | (.005) | (.008) |
| (2) Dummy if > 15 miles from VA (D15) | | .019 | .018 | | .006 | .011 |
| | | (.015) | (.019) | | (.007) | (.008) |
| (3) Dummy if > 30 miles from VA (D30) | | .016 | .022 | | .015 | .022 |
| | | (.012) | (.015) | | (.006) | (.007) |
| (4) DVA × change in log wage of RNs at nearest VA | .477 | .548 | .606 | .659 | .754 | .821 |
| | (.140) | (.163) | (.215) | (.139) | (.158) | (.219) |
| (5) (1 − DVA) × change in log wage of RNs at nearest VA | .149 | .227 | .268 | .331 | .438 | .485 |
| | (.137) | (.166) | (.212) | (.129) | (.156) | (.210) |
| (6) D15 × change in log wage of RNs at nearest VA | | −.134 | −.110 | | −.123 | −.111 |
| | | (.091) | (.117) | | (.096) | (.130) |
| (7) D30 × change in log wage of RNs at nearest VA | | −.060 | −.028 | | −.048 | −.061 |
| | | (.093) | (.118) | | (.080) | (.097) |
| Difference between hospital and second nearest competitor in: | | | | | | |
| (1) Dummy for VA hospital (DVA) | −.050 | −.051 | −.049 | .001 | .000 | .004 |
| | (.010) | (.011) | (.017) | (.006) | (.006) | (.011) |
| (2) Dummy if > 15 miles from VA (D15) | | −.003 | −.008 | | −.005 | −.016 |
| | | (.009) | (.010) | | (.005) | (.006) |
| (3) Dummy if > 30 miles from VA (D30) | | −.004 | −.012 | | −.004 | −.009 |
| | | (.013) | (.016) | | (.007) | (.008) |
| (4) DVA × change in log wage of RNs at nearest VA | .569 | .570 | .595 | .433 | .419 | .536 |
| | (.082) | (.080) | (.121) | (.100) | (.104) | (.152) |

**Table A1 (*Continued*)**

| Independent Variables | Using the Actual Change in the Log Wage at the Nearest VA (1) | (2) | (3) | Using the VA Log Wage Gap in 1990 as Proxy for Wage Change at the VA (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| (5) (1 − DVA) × change in log wage of RNs at nearest VA | .108 | .112 | .126 | .007 | −.019 | .107 |
| | (.064) | (.073) | (.102) | (.075) | (.100) | (.137) |
| (6) D15 × change in log wage of RNs at nearest VA | | .011 | −.020 | | .044 | −.019 |
| | | (.055) | (.058) | | (.073) | (.084) |
| (7) D30 × change in log wage of RNs at nearest VA | | −.007 | .019 | | −.011 | .006 |
| | | (.073) | (.107) | | (.081) | (.104) |
| Indicator if hospital is a VA | | | −.010 | | | −.016 |
| | | | (.015) | | | (.015) |
| MSA dummies? | No | No | Yes | No | No | Yes |
| $R^2$ | .254 | .258 | .360 | .203 | .208 | .322 |
| *F*-test of instruments (*p*-value) | 61.70 | 33.62 | 28.69 | 43.36 | 20.29 | 19.32 |
| | (.000) | (.000) | (.000) | (.000) | (.000) | (.000) |
| No. of observations | 1,334 | 1,334 | 1,334 | 1,334 | 1,334 | 1,334 |

Note.—Standard errors are in parentheses, clustered at the Metropolitan Statistical Area (MSA) level. Sample includes all non-VA hospitals within 60 miles of a VA hospital. All regressions are weighted by the number of hospital beds in 1990. All wages refer to starting (lowest) wages of RNs. Wages of competitors (compwage92 and compwage90) are the average log wage of the hospital's two closest competitors that report wages in both 1990 and 1992. Cols. 4–6 use the VA log wage gap in 1990 (log(market wage) − log(VA wage)) in place of the change in the log VA wage in constructing all independent variables. The market wage is constructed as discussed in the note to table 3. Dependent variable = [ln(wage92) − ln(wage90)] − [ln(compwage92) − ln(compwage90)].

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