NBER WORKING PAPER SERIES

ARE RECESSIONS GOOD FOR STAFFING IN NURSING HOMES?

R. Tamara Konetzka
Karen B. Lasater
Edward C. Norton
Rachel M. Werner

Working Paper 23402
http://www.nber.org/papers/w23402

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
May 2017

Karen B. Lasater received support from the National Institute of Nursing Research (T32-NR0714). Rachel M. Werner received support from the National Institute on Aging (K24-AG047908). The funders played no role in the study design, analysis, writing, or the decision to submit the paper for publication. The authors thank participants at the International Long-term Care Policy Network conference in London for comments. The authors declare that they have no relevant or material financial interests that relate to the research described in this paper. The views expressed herein are those of the authors and do not necessarily reflect the views of the National Bureau of Economic Research.

Are Recessions Good for Staffing in Nursing Homes?
R. Tamara Konetzka, Karen B. Lasater, Edward C. Norton, and Rachel M. Werner
NBER Working Paper No. 23402
May 2017
JEL No. E32,I11,J44,L84

ABSTRACT

The quality and cost of care in nursing homes depend critically on the number and types of nurses. Recent research suggests that the nursing supply adjusts to macroeconomic conditions. However, prior work has failed to consider the effect of macroeconomic conditions on demand for nurses through the effect on revenues. We test how county-level unemployment rates affect direct-care staffing rates in nursing homes using California data. We exploit the wide variation in the unemployment rates across counties and over time in 2005–2012. We also test whether there are heterogeneous effects of unemployment rates by facility size, staffing level, and profit status. We find that as unemployment rates increase, staffing by registered nurses (RNs) decreases but staffing by licensed practical nurses (LPNs) increases. The increase in LPNs is larger in large nursing homes, nursing homes with higher staffing levels, and in for-profit nursing homes. We also find that as unemployment rates increase, nursing home revenue decreases. While the effect of macroeconomic conditions on nursing supply may be important for cost and quality of care, the mechanism is not simple, direct, or homogeneous for all types of nurses and nursing homes.

R. Tamara Konetzka
University of Chicago
5841 S. Maryland Ave.,
MC 2007, Rm. W-255
Chicago, IL 60637-1447
tkonetzk@health.bsd.uchicago.edu

Karen B. Lasater
Center for Health Outcomes and Policy Research
University of Pennsylvania
School of Nursing
418 Curie Blvd.
Philadelphia, PA 19104
karenbl@nursing.upenn.edu

Edward C. Norton
Department of Health Management and Policy
Department of Economics
University of Michigan
School of Public Health
1415 Washington Heights, M3108 SPHII
Ann Arbor, MI 48109-2029
and NBER
ecnorton@umich.edu

Rachel M. Werner
University of Pennsylvania
and Philadelphia VAMC
Blockley Hall, room 1204
423 Guardian Drive
Philadelphia, PA 19104
rwerner@upenn.edu

I. INTRODUCTION

The quality and cost of care in nursing homes depend critically on the number and types of nurses (Castle, 2008; Backhaus et al., 2014; Dellefield et al., 2015; Spilsbury et al., 2011; Zhang, Xinzhi, & Grabowski, 2004). Therefore, an important question for policy is what determines both the demand for nurses and the supply of nurses. Health care providers are increasingly being held accountable for the quality and cost of care, and nurses will play an important role in how providers are judged and rewarded under value-based payments (Das et al., 2016). Public and private sector efforts have attempted to grow the nursing supply (Johnson & Johnson, 2017; Institute of Medicine, 2011), including policies that have focused on minimum staffing levels (Assembly Bill 394) and whether to accredit new schools of nursing (Buerhaus, Auerbach, & Staiger, 2014).

Recent research has proposed new ideas about how the number of employed nurses adjusts to macroeconomic conditions in ways unrelated to minimum staffing levels or the number of nursing school graduates. This line of research is motivated by Ruhm's observation that population health improves during recessions. Over a series of papers Ruhm has documented that total mortality across the population is inversely correlated with unemployment rates (Ruhm 2000, 2003), although this relationship has changed over time, becoming less procyclical recently (Ruhm, 2015). This procyclic varation in mortality is concentrated among those at prime working age but also exists in older age groups (Ruhm 2000, 2003) and infants (Dehejia and Lleras-Muney 2004). The mechanisms behind procyclic mortality are not well understood, but given that the effects are seen for segments of the population not typically in the labor force and that the magnitude is too large to derive only from working-age adults, it is hypothesized that mortality changes stem from other mechanisms that fluctuate with unemployment.

To address this question of the mechanism of procyclic mortality, Stevens and colleagues (2015) use state-year panel data models and find that own-group labor market indicators are not positivity correlated with mortality within group. They also find that nursing home deaths among those age 65 years and older account for the total cyclic variation in mortality. They posit that nursing homes' contribution to cyclic variation in mortality is driven by countercyclical staffing in nursing homes. That is, nursing home staffing improves when the economy falters, driving reductions in nursing home deaths. Using nursing home staffing data from the Online Survey Certification and Reporting (OSCAR) from 1990 to 2006, Stevens and colleagues find that as the state unemployment rates rise, the number of nurses working in a nursing home in that state rises as well. They estimate that a 1 percentage-point increase in the unemployment rate raises full-time employment of nurses and aides by about 3 percent. Based on this, they suggest that when the unemployment rate rises, the number of nurses in nursing homes improves to such a degree to explain the decline in mortality rates observed among the elderly.

There is evidence to support the idea that changes in nurse labor supply are driven by recessions. Using the Current Population Survey, Buerhaus and colleagues (2009) show that trends in nurse employment increased during two recent recessions. The authors speculate that this is motivated by anticipated declines in spousal income during recessions, an observation that is supported by some empirical research. A 2003 review of the nurse labor supply literature found that a number of recent studies documented that a spouse's wage and household income is negatively associated with labor force participation (Antonazzo and colleagues 2003). Additionally, Baughman and Smith (2012) show that direct-care workers in nursing homes have longer duration of employment when the unemployment rate is high. Thus, macroeconomic conditions may indeed greatly influence the number and types of nurses who are working, which in turn could affect population health enough to be measurable.

Our research extends this literature, taking into account both supply and demand of all direct-care staff including nurses and nurses' aides, whereas prior work has ignored the fact that macroeconomic conditions also affect demand for nurses. We provide a theoretical framework for how changes in the macro economy could affect both the supply and the demand of nursing care. In particular, our framework adds theory for why the macro economy affects demand, which in turn affects revenues, and builds on the discussion of supply in the prior literature. When unemployment rises and wages fall or stagnate, nursing homes will shift staffing to respond to both lower wages and lower demand (lower revenues) for nursing home care.

We argue that the effect of macroeconomic conditions on nursing demand is not simple, direct, or homogeneous for all types of providers and direct-care staff — the macro economy affects the different types of staff within nursing homes differently. The change in the supply of direct-care staff may also differ by the unemployment rate. We expect heterogeneity in the response to the unemployment rate — both by types of nurses and by types of providers. Heterogeneity is an important and interesting part of this story.

The main empirical research question is: how does the unemployment rate affect the net direct-care staffing rates in nursing homes, considering that the effect may vary across types of nurses and types of facilities? We exploit the wide variation in the unemployment rate across counties and over time during 2005–2012 and use data on direct-care staffing in nursing homes.

Our paper has several innovations. It lays out a conceptual framework of how unemployment affects direct-care staffing levels through both changes in supply and demand, and how that effect may be heterogeneous across types of staff in nursing homes and across nursing homes. The conceptual framework motivates the empirical work, which tests how staffing changed in nursing homes as a function of the local unemployment rate. We analyze the

best available data on staffing in California, combined with data on county-level unemployment rates.

Our results are largely consistent with our conceptual framework, although different than results found by Stevens and colleagues (2015). In general we find that during economic downturns, nursing homes do not change total employment of nurses, but shift from more expensive registered nurses (RNs) to less expensive licensed practical nurses (LPNs). At the same time, they experience a decline in net revenues.

II. CONCEPTUAL FRAMEWORK

The conceptual framework considers both the supply of nursing by individuals and the demand for staffing by nursing homes, and how supply and demand will change during a recession. We start with labor supply, then discuss labor demand, which derives in part from patient demand for health care services. The result is a set of testable predictions with more nuance than in the prior literature.

Starting with labor supply, as in the prior literature (Stevens et al., 2015) we assume that the supply of nurses and nurse aides will increase during a recession. During an economic boom, work in a nursing home in particular may be seen as less desirable than work in other settings or than leaving the labor force, due to stress and shift work or to better alternative opportunities (Hanel, Kalb, and Scott, 2014). In a recession, as other types of jobs disappear or cut back on hours, those with a nursing degree will be more likely to rejoin the labor force as a nurse (Buerhaus, Auerbach, and Staiger, 2009), although the response will differ by type of nurse.

For example, someone with a nursing degree who loses her non-nursing job would be more likely to take a job as a nurse. The same could happen if the spouse loses (or fears losing)

a job, or is forced to cut back on hours. In short, as other jobs disappear, the labor supply of nurses can increase as people come out of retirement, are willing to increase their hours, or in the longer run, get more education and training. This effect has been posited to be stronger for nurses than for other types of professions, in part because health care jobs are seen as less vulnerable to recessions and in part because the majority of RNs are married women who might move in and out of the labor force in response to the spouse's employment status (Staiger, Auerbach, and Buerhaus, 2012).

Studies of the labor supply of nurse aides are scarcer, but evidence also suggests that local economic conditions have a significant effect on nurse aide turnover and retention in nursing homes similar in direction to that for nurses (Stone and Wiener, 2001). The supply of nurse aides may increase as workers shift from non-health sectors more affected by a recession (such as child care or retail) to health care. For all categories of staff, these effects may be mitigated by the availability of unemployment insurance; however, the broader literature on unemployment benefits has generally found these effects to be small – neglible for unemployment status and effectively zero for labor force participation (Figura and Barnichon, 2014). Thus, during a recession nursing homes will face a labor supply curve that shifts outward, lowering labor costs. *Ceteris paribus*, during a recession nursing homes would be expected to hire more direct-care staff, pay lower wages, or both.

Despite consistency of direction, the supply curves may be shaped differently for different types of nurse staffing. RNs are more highly trained and command higher wages than LPNs (and than nurse aides, who are generally minimum-wage workers without post-secondary education or formal nurse training). RNs, having invested more time in training, would be expected to have less elastic supply than LPNs and aides. Hanel and colleagues (2014) found

that the nursing supply elastiticy varies by education — specifically that nurses with higher education have more inelastic supply. Therefore, the supply curve for RNs is steeper than for LPNs and nurse aids, and shifted inwards.

On the demand side, however, health care providers face additional consequences of a recession due to shifts in the demand for services. Nursing home care is typically paid by one of three main sources: Medicaid, covering 63 percent of residents on average; Medicare, covering only post-acute care for 14 percent of residents on average; and private resources, covering 23 percent of residents on average, all based on 2014 statistics (Kaiser Family Foundation, 2015). In a recession, demand by nursing home residents will likely decline, especially for those who pay out of pocket. The decline in demand among private-pay residents derives from two mechanisms. First, although the elderly are less affected than working-age adults by shocks to employment, they are potentially more affected than other groups by shocks to wealth. Surveys of the elderly found that during the Great Recession, spending by the elderly on health care declined on the order of 10% (National Research Council, 2011) and that the elderly felt substantially worse about their asset position than other segments of the population (Petev and Pistaferri, 2012). Second, older adults may benefit from an increased supply of informal care as their adult children leave the formal labor market. For example, a recent study finds evidence of both increased informal care and decreased purchase of formal care among older European adults during the Great Recession (Font, Karlsson, and Oien, 2015).

The change in demand from Medicaid residents during a recession is slightly more ambiguous than in the private-pay case. The fraction of Medicaid residents may increase because more people will qualify for Medicaid as declining wealth makes it easier to meet Medicaid's asset tests. However, demand by Medicaid residents could also decrease due to greater

availability of informal care, similar to the private-pay case. The direction of the net effect is uncertain.

Figure 1 depicts the shift in demand for nursing home care that might be expected in a recession, using a traditional Scanlon (1980) and Nyman (1985) two-payer framework (see also Norton 2000). A nursing home faces a downward-sloping demand curve from private-pay residents but a flat demand curve from Medicaid residents due to administratively set prices by Medicaid. The Medicaid price is lower than the private-pay price. The private-pay price is set to maximize private-pay revenues, and private-pay residents are accepted up to the point where marginal private-pay revenues equal the Medicaid rate. After that, Medicaid residents are accepted. In a recession, for the reasons outlined above, demand from private-pay residents shifts left, resulting in fewer private-pay residents and a lower private-pay price. If demand among Medicaid recipients increases or even stays the same, the number of Medicaid residents may increase due to greater availability of beds when private-pay demand declines. Although the ultimate effect on payer mix and the total number of residents is ambiguous, we unambiguously expect lower nursing home revenues during a recession, whether through lower price, more disadvantageous payer mix, or both.

We intentionally ignore Medicare-funded nursing home care in this simple framework, but the addition of Medicare would not affect our predictions. Eligibility for Medicare is universal after age 65, so that eligibility is unrelated to the economy. Medicare pays for limited post-acute care for those who have a hospital stay of at least three days, and this demand is fairly unresponsive to the macro economy (Levine and Buntin, 2013).

Nursing homes employ a mix of the three direct-care staff types, with some substitutability between RN and LPN tasks. RNs observe, assess, and record resident symptoms

and progress, overseeing the work of nurse aides and LPNs. RNs also collaborate with physicians in treatment, administration of medications, and development of care plans. LPN responsibilities often include medication administration, charting in the medical record, taking vital signs, and wound care(Assisted Living Today, 2017). While scope of practice regulations vary somewhat from state to state, LPNs are generally more limited in what they are allowed to do and must practice under supervision of an RN. At the same time, there is some overlap in potential duties and thus the potential for substitution, and duties often look similar for RNs and LPNs in nursing homes (Burger et al., 2009). Finally, nurse aides provide the majority of direct care to residents. This care is nontechnical and consists primarily of helping residents with activities of daily living (ADLs) such as eating, dressing, bathing, toileting, and walking (Cawley, Grabowski, and Hirth, 2006).

Nursing homes face regulatory requirements to have a minimum RN presence in the facility regardless of nursing home size and must employ sufficient staff overall to meet care needs, but have some flexibility as to staff mix. Nursing homes face federal regulatory requirements to have an RN for at least 8 consecutive hours per day and California regulatory requirements to have an RN or LPN in the facility 24 hours per day. (Note that the California regulations were implemented before our study period begins.) Figure 2 presents stylized pictures of labor supply and demand in nursing homes for each type of direct-care worker, with the expected outward shift in labor supply during a recession.

Although there is some substitutability among types of staff in nursing homes, the mix of staff is likely to affect quality. Specifically, a substantial literature associates more RN hours, or more RN hours as a proportion of total staff hours, with better patient outcomes as measured by various process and outcome indicators. Examples include improved survival and better

functional status (Cohen and Spector 1996), fewer pressure sores (Cohen and Spector 1996; Konetzka Stearns and Park 2008; Horn and colleagues 2005), fewer urinary tract infections (Konetzka Stearns and Park 2008; Horn and colleagues 2005), and fewer hospitalizations (Horn and colleagues 2005). Consumers appear to recognize the importance of staffing as a determinant of quality when choosing a nursing home (Konetzka and Coca Perraillon, 2016).

When the supply curve for nurses and nurse aides shifts out during a recession, nursing homes may be able to hire more staff at lower wages. While theoretically wages should fall during a recession as the supply of unemployed nurses increases, empirical evidence supporting this theory is mixed. Studies testing this theory have been limited by empirical difficulties in identifying the relationship between economic cycles and wages (Antonazzo, Skatun, and Elliott, 2003). Additionally, wage rates may be "sticky", or slow to respond to changes in the economic cycle. The wages of workers who remain employed may stay the same or even grow during a recession rather than falling with the general decrease in demand for labor. While the issue of sticky wages is important and creates some uncertainty about whether wages will fall for nurses employed in nursing homes, it does not affect the prediction that the supply of nurses available to nursing homes should increase during a recession. Unfortunately, without data on wage rates, we cannot directly observe whether changes in wage rates is a specific mechanism for changes in the demand for nurses. Nonetheless, we can still comment on the outcomes of interest—that is, net nurse staffing levels.

We would not expect an increase in all types of staff or in all types of nursing homes when we also consider the source of the shocks to revenues. Because the private-pay demand is likely to decrease, lowering the fraction of residents in a typical nursing home who can be charged a market price, the fraction of residents whose demand is sensitive to changes in quality

decreases and the overall elasticity of demand for quality could change (Nyman, 1985; Grabowksi 2001). This means that nursing homes can shift resources from RNs to LPNs and aides. LPNs in particular have authority to perform many tasks that are also performed by RNs, such as administration of medications, although they have less formal and fewer years of training and arguably provide a lower level of nursing expertise. This overall expected shift in staffing composition does not apply to small nursing homes that face binding regulatory constraints on the minimum number of RNs. Small nursing homes will typically be at the minimum threshold with no ability to substitute away from RNs to LPNs and aides. Therefore we expect a difference in response between large and small nursing homes.

Our conceptual framework has four testable hypotheses. First, as unemployment rises, nursing home revenues will decrease. Second, nursing homes will hire more nurses overall. Third, nursing homes will shift away from RNs to LPNs and aides. Fourth, this shift will be larger in the largest nursing homes (those with more than 60 beds) and potentially zero in small nursing homes that are constrained by staffing regulations.

III. EMPIRICAL STRATEGY

We use a longitudinal nursing home fixed-effects strategy to examine how the local unemployment rate affects direct-care staffing levels and net revenue in nursing homes, using variation in the local unemployment rate across counties and over time to identify the effect. To analyze the effect of the unemployment rate on direct-care staffing we estimate the following reduced-form ordinary least squares regression:

$$\text{Staff}_{jmt} = \beta \text{Unemployment}_{mt} + \tau_t + \gamma_j + \varepsilon_{jmt} \qquad (1)$$

where our outcome of interest is the number of staff hours per resident day (Staff_{jmt}) for nursing hone j, located in county m, in year t. We also control for time fixed effects τ_t, and nursing home fixed effects γ_j. In some models we stratify by nursing home characteristics. The error term is ε. We consider staffing hours for RNs, LPNs, and aides separately and also a facility's total staff hours across all three staff types. We also consider the ratio of RN hours to total staff hours as an outcome, for a total of five staffing-related outcomes and regressions. Finally, to test a potential mechanism of any observed changes in staffing during a recession, we re-estimate equation (1) replacing net revenues for staffing levels as the dependent variable. In all specifications, standard errors are clustered at the facility level.

The Stevens and colleagues (2015) paper finds that an increase in unemployment leads to an increase in nursing home staffing, meaning that $\beta > 0$. Following from our conceptual model, we hypothesize a more nuanced view that β will be positive for some, but not all, types of direct-care nursing home staff. We also explore whether there are heterogeneous effects of unemployment rates by facility characteristics. We test whether there are different effects by facility size (number of beds), staffing level, and profit status.

Specifically, our testable hypotheses from the conceptual framework are:

1. In a model to predict nursing home net revenues, $\beta < 0$.
2. In a model to predict overall nurse staffing in nursing homes, $\beta > 0$.
3. In a model to predict RN staffing in nursing homes, $\beta < 0$, but in models to predict LPN and nurse aide staffing, $\beta > 0$.
4. When stratified by nursing home size, $\beta > 0$ for large nursing homes and $\beta \approx 0$ for small nursing homes.

The facility fixed effects account for any facility time-invariant unobservable factors (and observable factors) that affect the outcomes of interest. They also subsume county fixed effects. The inclusion of year fixed effects in the above specifications allows us to control for any systematic trends in staffing or revenue that affect all nursing homes. This is a conservative approach, as it controls for secular trends affecting the nursing supply or health care demand but, in doing so, does not allow us to exploit the large increase in unemployment during the 2008/9 recession. Thus, identification relies on the extent to which trends over time in unemployment vary from county to county, and the corresponding within-facility variation in our outcomes. We test the robustness of this specification by replacing year fixed effects with county-specific trends and, in the national sample, state-specific trends and state-time dummies.

Finally, we weight each regression by the bed size of each nursing home to assess whether underweighting large facilities in facility-level regression affects the results.

IV. DATA

This study uses secondary data sets from two sources. We obtain data on staffing and organizational characteristics in California nursing homes from the annual data files from California's Office of Statewide Health Planning and Development (OSHPD). We collect county-level unemployment rates from the Area Health Resources File.

We restrict our analysis to California nursing homes due to concerns of biased over-reporting among nursing homes nationally in the Centers for Medicare & Medicaid Services' (CMS) Online Survery, Certification and Reporting (OSCAR) database. OSHPD data is rigorously audited by the state of California. In our comparisons with OSCAR, nursing home-

year level staffing estimates are substantially lower in OSHPD (tables of comparisons available upon request) and our estimates of staffing levels from OSHPD are consistent with prior work (Kim et al, 2009).

IV.A. Study Sample

Our sample of nursing homes comprises non-governmental skilled or intermediate care nursing homes in California from 2005-2012. The initial sample includes 9,081 unique observations from 1,172 nursing homes. We exclude nursing homes that are neither skilled nursing nor intermediate care (n = 113). We also exclude nursing homes that are less likely to make staffing decisions independent of the entity that owned them: hospital-owned (n = 8) and government-owned nursing homes (n = 2). To eliminate outliers that are most likely due to data errors, we also exclude nursing homes with more than 12 total nurse hours per patient day (n = 3), and those with no reported RNs in nursing homes greater than 60 beds (n = 2) (Park and Stearns, 2009). The final sample of California nursing homes includes 8,086 unique observations from 1,044 nursing homes from 2005–2012.

IV.B. Dependent Variables

We examine two sets of outcome measures — facilities' direct-care staffing levels and revenues (see Table 1). Facility direct-care staffing is measured in minutes per resident day (PRD), and categorized by the types of staff: RNs, LPNs, aides, total direct-care staff — which represented the sum of RN, LPN, and aide hours. We also include a measure of nursing skill mix defined by the ratio of RN hours to total direct-care staff hours. Our measure of net revenues is a

facility's total net health care revenue (the sum of the net routine services revenue, net ancillary services revenue, and other operating revenue from providing health care services to residents).

IV.C. Unemployment Variable

Our predictor of interest is the county-level unemployment rate. Unemployment rates are measured annually using data obtained from the Area Health Resources File. In each study year, the unemployment rate is reported among individuals 16 years and older. This definition has been widely used in the health services literature (Maeda et al., 2014). The average county-level unemployment rate in California during the study period was 8.9%, and ranged from 2.2% to 29.9% over the study period (see Figure 3). The average national county-level unemployment rate was 7.0%, and ranged from 1.7% to 29.7%. The typical within-county fluctuation across the eight years was 19.8% in California and 16.1% nationally. We rely on this variation within county over time to identify the effect of economic booms and busts on the outcomes. The unemployment rate thus serves as a proxy for the effects of these macroeconomic trends, where the mechanism of effect may be unemployment itself or wealth shocks to the elderly that affect spending on nursing home care. We note that nursing homes in each county in California employ at most about 2% of employed individuals, so there is no concern of monopsony behavior biasing our estimates.

IV.D. Other Variables

Facility characteristics used to stratify the regression models included: size, total nurse staffing level, and profit status (see Table 1). We classified facilities into two groups according to their size defined by approximately the 25th percentile of the number of beds: small (<=60

beds) and large (>60 beds). Similarly, we classified direct-care staffing levels into two groups defined as: low (≤ mean total staffing in all nursing homes) and high (> mean total staffing in all nursing homes). Profit status was either for profit or nonprofit. The stratification by nursing home size was to test the fourth hypothesis.

V. RESULTS

For California nursing homes, an increase in unemployment led to an increase in the staffing level of LPNs, a decrease in RNs, and no change in aides or total direct-care staffing levels (see the first column of Table 2 for unstratified results). A one-percentage point increase in the unemployment rate was associated with a decrease in RN minutes PRD of 0.57 and an increase in LPN minutes PRD of 0.77. In relative terms, this translates into a 2.8% decline in RN staffing and a 1.7% increase in LPN staffing. There was no statistically significant effect of the unemployment rate on the ratio of RN to total hours.

When stratifying by nursing home characteristics, we also find a statistically significant decrease in RN staffing and an increase in LPN staffing among large nursing homes, nursing homes with high average staffing levels, and for-profit nursing homes. In the case of nursing homes with high staffing, we also found a decline in the ratio of RN-to-total-staff levels, suggesting that either through demand or supply, during recessions there is a shift away from RNs towards LPNs. The results for small nursing homes, and non-profit nursing homes were similar in magnitude to the non-stratified results but not statistically significant.

We also estimate declines in net revenue among California nursing homes during recessions (see Table 3). We find that a one-percentage point increase in unemployment was associated with a decrease in net revenue of over $114,000, a relative decline of 1.7%. Similar to

the results of recession on staffing, we also find that an increase in unemployment is associated with a larger decline in revenue for large nursing homes, nursing homes with low staffing, and for-profit nursing homes.

We perform a number of tests of the robustness of our results. First, we re-estimate the relationship between unemployment in all nursing homes nationally, using data from The Centers for Medicare and Medicaid Services' (CMS) Online Survey, Certification and Reporting (OSCAR) database (see Table 4). We find similar results to our California results among the total sample, large nursing homes, nursing homes with low staffing levels, and for-profit nursing homes, though the magnitude and statistical significance differ somewhat. This gives us more confidence that our results from California generalize to the entire country. Second, we re-estimate the main regressions using alterative controls for time (see Table 5). We find similar results for California nursing homes, with estimates in the same direction and most not statistically significant. In the national sample of nursing homes, the effect of unemployment on RN staffing becomes negative and marginally significant with state-specific time trends, a consistent result with the California sample. Third, we weight each regression by the bed size of each California nursing home to assess whether underweighting large facilities in facility-level regression affects the results (see Table 6). Results from this specification are qualitatively similar to the main results.

Finally, because prior estimates of the effect of changes in unemployment rates on nurse and aide staffing levels in nursing homes have been positive (Stevens et al. 2015), we estimate a number of alternative specifications on the national sample of nursing homes to try to recreate these prior results (see Table 7). To do so, we focus on the two types of nurse staffing examined by Stevens (nurses, or the combination of RNs and LPNs, and aides). In various specifications

we add a set of control variables (population demographics and number of nursing home beds) plus alternative controls for time (state-specific time trends, state-year dummies, and county-specific time trends) with and without taking the log of the dependent variable. In these specifications our estimates remain close to zero and insignificant.

VI. CONCLUSIONS

The macro economy has a strong influence on the number and types of nurses hired in nursing homes. However, we find a different, more complex pattern than the one reported by Stevens and colleagues (2015). Unlike them, we find no significant increase in total employment in nursing homes when the unemployment rate rises. A key difference might explain why our results are not the same—we measure staffing as a ratio of nursing time (e.g., minutes) per resident-day whereas Stevens measures staffing as the number of nurses. Stevens' approach could overstate true employment levels particularly if there is an increase in the use of part-time workers during a recession. However, we do find changes in the types of nurses employed, with large for-profit nursing homes shifting away from RNs towards less expensive LPNs.

One mechanism for these shifts may be the change in revenue that we document. During recessions, nursing home revenue declines. To cover costs, nursing homes would then need to reduce the number of staff or shift to less expensive nurses.

Our findings should be viewed with respect to several limitations. First, in order to control for secular trends that may be collinear with recession, our primary specification does not capitalize fully on the increase in unemployment during the recession starting in 2008, the most dramatic change during our study period. Rather, our identification depends on variation in county-specific changes in unemployment, as some counties were affected more than others.

However, alternative specifcations that do not include time fixed effects are consistent with our main specification. Second, our data on staffing allows us only to examine staffing type and staffing ratios, not the quality or tenure of staff within type. Thus, if facilities shift from highly experienced RNs to less experienced RNs at lower wages, our analysis will not be able to detect it. Third, although we would ideally control for nurses' marital status, the data do not have this information. If RNs are more likely to have highly educated spouses than nurses aides, the different types of nurses would face different economic pressures during recessions. Furthermore, Auerbach, Buerhaus, and Staiger (2015) found that RNs with an associate degree are increasingly employed in long-term care, while RNs with a bachelors degree are increasingly employed in hospitals. Because we do not observe private-pay prices, we focus on total revenues and are unable to parse out the exact mechanisms behind declining revenues in a recession.

Nonetheless, our findings have several important implications. First, they show that it is important to consider changes in demand for health care services when assessing the effect of macroeconomic cycles on health care staffing. In the presence of changes in patient demand, the net effect of a shift in nursing supply becomes theoretically ambiguous, and we show that revenues do appear to be affected by economic booms and busts. Second, nursing homes do appear to operate on a margin where economic conditions affect their ability to hire nursing staff. Regulations and administratively set payment rates for nursing home care should potentially consider the state of the economy and the nurse labor market if minimum RN staffing is to be required. At the same time, policymakers may want to take a closer look at the scope of practice between RNs and LPNs in nursing homes to assess the extent of substitutability desired or allowed in order for nursing homes to meet minimum quality standards. Finally, we show

evidence that the market for nurses in nursing homes is somewhat sensitive to the macro economy. Whether or not these changes in staffing affect morbidity and mortality is a question that should be pursued further.

REFERENCES

Akosa Antwi, Yaa and John R. Bowblis. 2016. "The Impact of Nurse Turnover on Quality of Care and Mortality in Nursing Homes: Evidence from the Great Depression." Upjohn Institute Working Paper 16-249. Kalamazoo, MI: W.E. Upjohn Institute for Employment Research. http://dx.doi.org/10.17848/wp15-249.

Antonazzo, Emanuela, Anthony Scott, Diane Skatun, and Robert F. Elliott. 2003. "The labour market for nursing: A review of the labour supply literature." *Health Economics* 12(6): 465-478.

Assembly Bill 394. 1999. Cal Bus Prof Code §2725.3; Health Safety Code §1276.4

Assisted Living Today. 2017. "The Role of Nurses in a Nursing Home" (blog). http://assistedlivingtoday.com/blog/the-role-of-nurses-in-a-nursing-home/

Auerbach, David I., Peter I. Buerhaus, Douglas O. Staiger. 2015. "Do Associate Degree Registered Nurses Fare Differently in the Nurse Labor Market Compared to Baccalaureate-Prepared RNs?" *Nursing Economics* 33 (1): 8–13.

Backhaus, Ramona, Hilde Verbeek, Erik van Rossum, Elizabeth Capezuti, and Jan PH Hamers. 2014. "Nurse staffing impact on quality of care in nursing homes: a systematic review of longitudinal studies." *Journal of the American Medical Directors Association* 15 (6): 383-393.

Baughman, R.A. and K.E. Smith. 2012. "Labor mobility of the direct care workforce: Implications for the provision of long-term care." *Health Economics* 21(12): 1402-1415.

Buerhaus, Peter I., David I. Auerbach, & Douglas O. Staiger. 2014. "The rapid growth of graduates from associate, baccalaureate, and graduate programs in nursing." *Nursing Economic* 32(6), 290-295, 311.

Buerhaus, Peter I., David I. Auerbach, & Douglas O. Staiger. 2009. "The Recent Surge in Nurse Employment: Causes and Implications." *Health Affairs* 28 (4): 657–668.

Burger, Sarah Green, Bonnie Cantor, Mathy Mezey, Ethel Mitty, Malvina Kluger, Donna Algase, Kathryn Anderson, Cornelia Beck, Christine Mueller, and Joanne Rader. 2009. "Nurses Involvement in Nursing Home Culture Change: Overcoming Barriers, Advancing Opportunities." Issue Paper. Hartford Institute for Geriatric Nursing, New York University College of Nursing. http://www.socialworkers.org/practice/aging/documents/issuePaper0609.pdf

Castle, Nicholas G. 2008. "Nursing home caregiver staffing levels and quality of care a literature review." *Journal of Applied Gerontology* 27(4): 375-405.

Cawley, John, David C. Grabowski, and Richard A. Hirth. 2006. "Factor substitution in nursing homes." *Journal of Health Economics* 25(2): 234-247.

Cohen, Joel W., and William D. Spector. 1996. "The effect of Medicaid reimbursement on quality of care in nursing homes." *Journal of Health Economics* 15(1): 23–48.

Das, Anup, Edward C. Norton, David C. Miller, Andrew M. Ryan, John D. Birkmeyer, Lena M. Chen. 2016. "Adding a spending metric to Medicare's value-based purchasing program rewarded low-quality hospitals." *Health Affairs* 35(5):898–906.

Dehejia, Rajeev, Adriana Lleras-Muney. 2004. "Booms, busts, and babies' health." *Quarterly Journal of Economics* 119(3):1091–1130.

Dellefield, Mary Ellen, Nickolas G. Castle, Katherine S. McGilton, and Karen Spilsbury. 2015. "The relationship between registered nurses and nursing home quality: An integrative review (2008-2014)." *Nursing Economics* 33(2): 95.

Figura, Andrew and Regis Barnichon. 2014. "The effects of unemployment benefits on unemployment and labor force participation: Evidence from 35 years of benefits extensions." https://www.federalreserve.gov/pubs/feds/2014/201465/201465pap.pdf

Font, Joan Costa, Martin Karlsson, and Henning Oien. 2015. "Informal Care and the Great Recession." CEP Discussion Paper No. 1360. Centre for Economic Performance, London School of Economics and Political Science http://cep.lse.ac.uk/pubs/download/dp1360.pdf

Grabowski, David C. 2001. "Medicaid reimbursement and the quality of nursing home care." *Journal of Health Economics* 20 (4):549–569.

Hanel, Barbara, Guyonne Kalb, and Anthony Scott. 2014. "Nurses' labour supply elasticities: The importance of accounting for extensive margins." *Journal of Health Economics* 33: 94–112.

Horn, Susan D., Peter Buerhaus, Nancy Bergstrom, and Randall J. Smout. 2005. "RN staffing time and outcomes of long-stay nursing home residents - Pressure ulcers and other adverse outcomes are less likely as RNs spend more time on direct patient care." *American Journal of Nursing* 105(11): 58–70.

Institute of Medicine. 2011 *The Future of Nursing: Leading Change, Advancing Health*. Washington, DC: The National Academies Press.

Johnson & Johnson. 2017. *The Campaign for Nursing's Future.* Accessed March 6, 2017. https://www.discovernursing.com/

Kaiser Family Foundation. 2015. *Nursing Facilities, Staffing, Residents and Facility Deficiencies, 2009 Through 2014*. http://kff.org/medicaid/report/nursing-facilities-staffing-residents-and-facility-deficiencies-2009-through-2014/

Kim, Hongsoo, Christine Kovner, Charlene Harrington, William Greene, and Mathy Mezey. 2009. "A panel data analysis of the relationships of nursing home staffing levels and standards to regulatory deficiencies." *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, 64B (2): 269-278.

Konetzka, R.Tamara, Sally C. Stearns, and Jeongyoung Park. 2008. "The staffing-outcomes relationship in nursing homes." *Health Services Research* 43(3): 1025–1042.

Konetzka, R.Tamara, and Marcelo Coca Perraillon. 2016. "Use Of Nursing Home Compare Website Appears Limited By Lack Of Awareness And Initial Mistrust Of The Data." *Health Affairs* 35(4):706-713.

Levine, Michael and Melinda Buntin. 2013. "Why Has Growth in Spending for Fee-For-Service Medicare Slowed?" Congressional Budget Office Working Paper 2013-06. Washington, D.C. https://www.cbo.gov/sites/default/files/44513_MedicareSpendingGrowth-8-22.pdf

Maeda, Jared Lane K., Rachel Mosher Henke, William D. Marder, Zeynal Karaca, Bernard S. Friedman, and Herbert S. Wong. 2014. "Association between the unemployment rate and inpatient cost per discharge by payer in the United States, 2005–2010." *BMC Health Services Research* 14: 378.

National Research Council. 2011. "Consumption, Savings, Pensions, and Wealth" in *Assessing the Impact of Severe Economic Recession on the Elderly:Summary of a Workshop*. M. Majmundar, Rapporteur. Steering Committee on the Challenges of Assessing the Impact of Severe Economic Recession on the Elderly. Committee on Population, Division of Behavioral and Social Sciences and Education. Washington, DC. The National Academies Press.

Norton, Edward C. 2000. "Long-term Care." In Handbook of Health Economics, Volume IB, A.J. Culyer and J.P. Newhouse, eds, pp. 956–994. New York, NY: Elsevier Science B.V.

Nyman, John A. 1985. "Prospective and Cost-Plus Medicaid Reimbursement, Excess Medicaid Demand, and the Quality of Nursing Home Care." *Journal of Health Economics* 4(3):237–259.

Park, Jeongyoung, and Sally C. Stearns. 2009. "Effects of State Minimum Staffing Standards on Nursing Home Staffing and Quality of Care." *Health Services Research*. 44 (1): 56–78.

Petev, Ivaylo D., and Luigi Pistaferri. 2012. "Consumption in the Great Recession." A Great Recession Brief. Standford, CA: Stanford Center on Poverty and Inequality. https://web.stanford.edu/group/recessiontrends/cgibin/web/sites/all/themes/barron/pdf/Consumption_fact_sheet.pdf

Ruhm, Christopher J. 2000. "Are recessions good for your health?" *Quarterly Journal of Economics* 115 (2): 617–650.

Ruhm, Christopher J. 2003. "Good times make you sick." *Journal of Health Economics* 22 (4): 637–658.

Ruhm, Christopher J. 2015. "Recessions, healthy no more?" *Journal of Health Economics* 42:17–28.

Scanlon, W.J. 1980. "A Theory of the Nursing Home Market." *Inquiry* 17:25-41.

Sochalski, Julie, R. Tamara Konetzka, Jingsan Zhu, and Kevin Volpp. 2008. "Will mandated minimum nurse staffing ratios lead to better patient outcomes?" *Medical Care* 46 (6): 606–613.

Spilsbury, Karen, Catherine Hewitt, Lisa Stirk, and Clive Bowman. 2011. "The relationship between nurse staffing and quality of care in nursing homes: a systematic review." *International journal of nursing studies* 48, (6): 732-750.

Staiger, Douglas O., David I. Auerbach, and Peter I. Buerhaus. 2012 "Registered nurse labor supply and the recession—Are we in a bubble?" *New England Journal of Medicine* 366: 1463-1465.

Stevens, Ann H., Douglas L. Miller, Marianne E. Page, and Mateusz Filipski. 2015. "The best of times, the worst of times: Understanding pro-cyclical mortality." *American Economic Journal: Economic Policy* 7 (4): 279–311.

Stone, Robyn I., and Joshua M. Wiener. 2001. "Who will care for us? Addressing the Long-Term Care Workforce Crisis." The Urban Institute and the American Association of Homes and Services for the Aging. https://aspe.hhs.gov/system/files/pdf/73111/ltcwf.pdf

Zhang, Xinzhi, and David C. Grabowski. 2004. "Nursing home staffing and quality under the nursing home reform act." *The Gerontologist* 44, (1): 13-23.

Figure 1: Demand for Nursing Home Care with Shift During a Recession

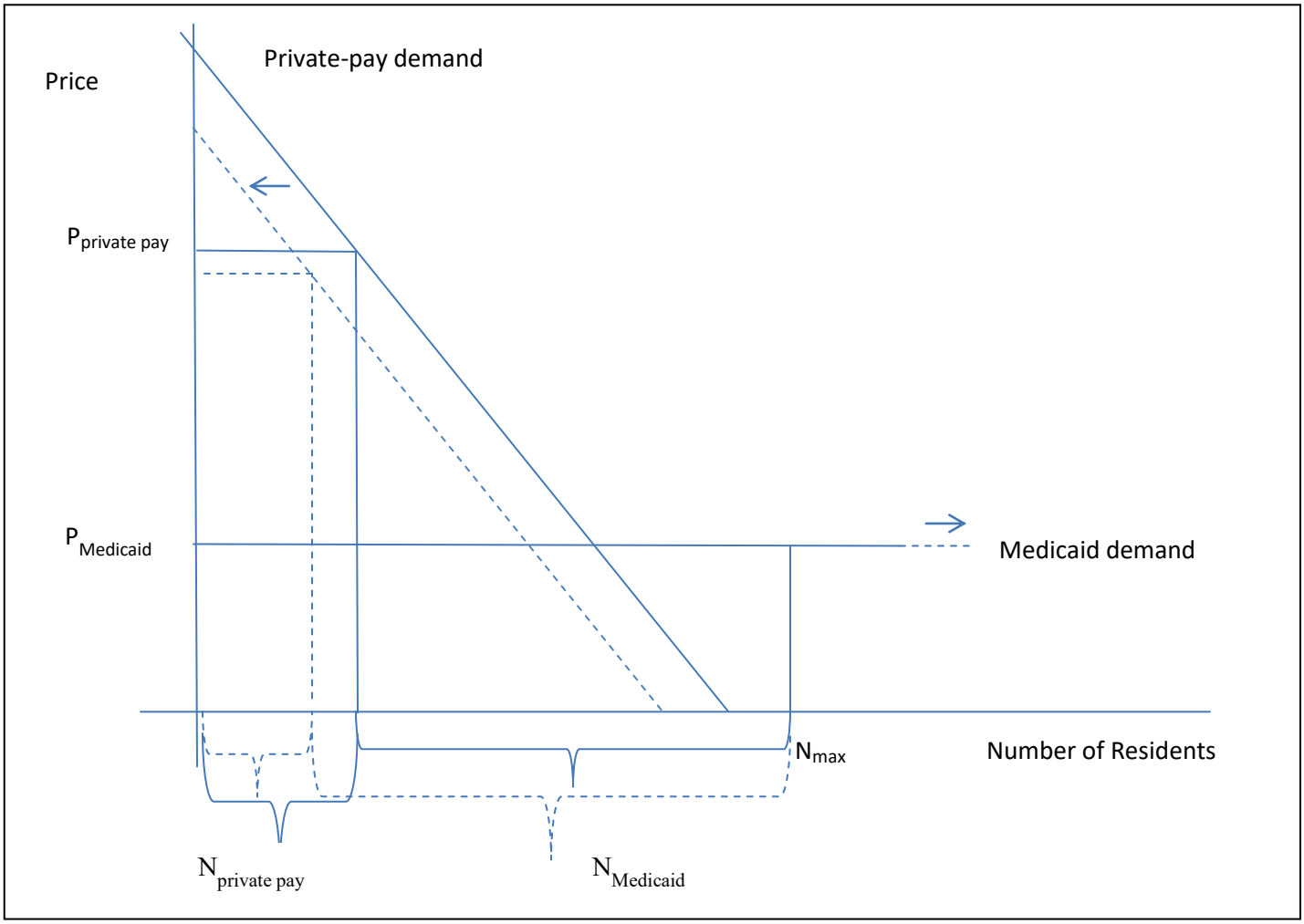


Figure 2: Supply and Demand of Direct-Care Staff in Nursing Homes, with Supply Shift During a Recession

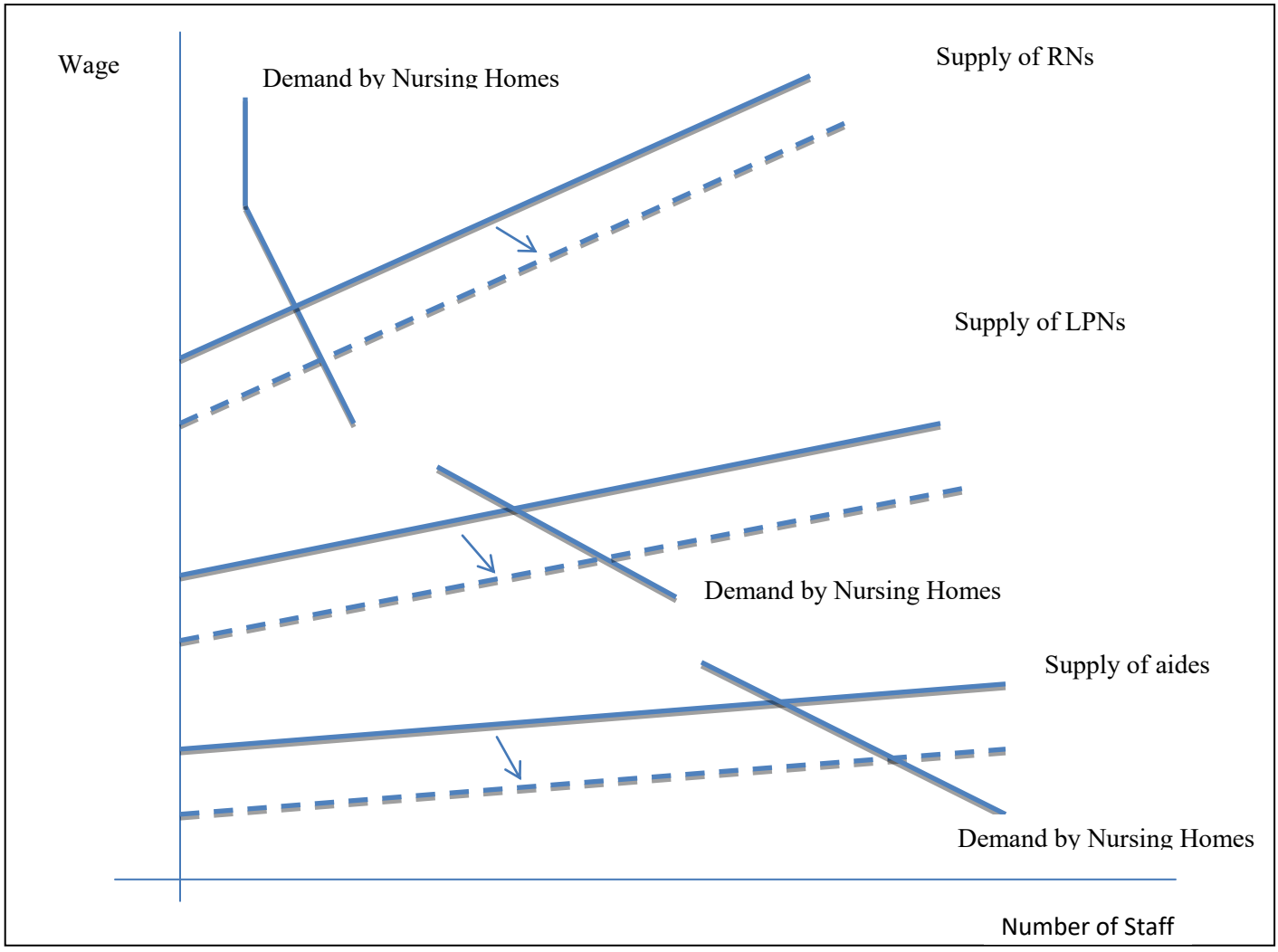
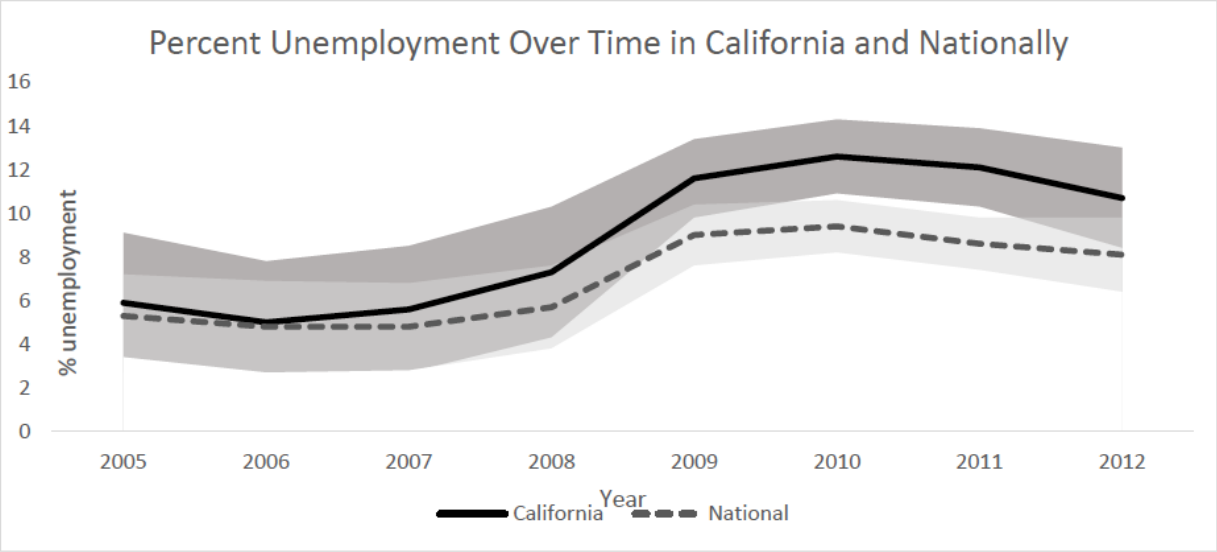


Figure 3. Percent Unemployment Over Time in California and Nationally



Note. Mean and standard deviation of county-level percent unemployment in California and nationally.

Table 1. Characteristics of California Nursing Homes, 2005-2012

Characteristics	**California Nursing Homes**, (N = 1,044)
Dependent variables	
Mean Total Nurse Minutes PRD, (SD)	214.1 (28.7)
Mean RN Minutes PRD, (SD)	20.0 (11.7)
Mean LPN Minutes PRD, (SD)	45.6 (12.9)
Mean Aides Minutes PRD, (SD)	148.5 (19.9)
Mean RN/Total Minutes PRD, (SD)	0.09 (0.05)
Other facility characteristics	
Mean Number of Beds, (SD)	95.02 (47.56)
Percentage Small Size, (n)	30.08 (314)
Percentage Large Size, (n)	69.92 (730)
Percentage Low Staffing, (n)	66.19 (691)
Percentage High Staffing, (n)	33.81 (353)
Percentage For-Profit, (n)	86.59 (904)
Percentage Non-Profit, (n)	13.41 (140)
Mean Net Revenue (SD)	6,898.48 (3,789.17)

PRD (per resident day)
Small size is defined by nursing homes with <=60 beds
Large size is defined by nursing homes with >60 beds
Low staffing is defined by a mean total nurse staffing less than or equal to the mean of total nurse staffing across all nursing homes; Mean total staffing within low staffing nursing homes is 200.4.
High staffing is defined by a mean total nurse staffing greater than the mean of total nurse staffing across all nursing homes; Mean total staffing within high staffing nursing homes is 240.7..
Mean net revenue reported in thousands of dollars.

Table 2. Effect of a 1%-point Change in Unemployment on Nurse Staffing Minutes per Resident Day in California Nursing Homes, 2005-2012

	California nursing homes	Stratified by Number of Beds		Stratified by Staffing		Stratified by Profit Status	
		Small	Large	Low staffing	High staffing	For-Profit	Non-Profit
RNs	-0.5659* (0.2923)	-0.2895 (0.4974)	-0.7278** (0.3620)	0.07123 (0.2698)	-1.2353** (0.6006)	-0.4600 (0.2897)	-0.4314 (0.6639)
LPNs	0.7702*** (0.2657)	0.7847 (0.5497)	0.8135*** (0.2853)	0.4496** (0.2503)	1.5079*** (0.5335)	0.9046*** (0.2630)	0.7580 (0.8968)
Aides	-0.5226 (0.4960)	-0.8464 (1.2016)	-0.2034 (0.4282)	-0.2651 (0.3137)	-0.5044 (1.1471)	-0.2781 (0.3888)	-0.6822 (2.1177)
Total	-0.3184 (0.6775)	-0.3512 (1.4665)	-0.1177 (0.6896)	0.2557 (0.3499)	-0.2318 (1.5863)	0.1665 (0.5432)	-0.3556 (2.6515)
RN/Total	-0.0011 (0.0011)	0.0003 (0.0021)	-0.0020 (0.0013)	0.0008 (0.0013)	-0.0035* (0.0021)	-0.0013 (0.0012)	0.0002 (0.0025)
No. nursing homes	1,044	314	730	691	353	904	140
No. observations	8,086	2,388	5,698	5,379	2,707	7,047	1,039

All of the models include year and nursing home fixed effects. Robust standard errors in parentheses.
*p<0.10 **p<0.05 ***p<0.01

Table 3. Effect of a 1%-point Change in Unemployment on Total Net Revenue in California Nursing Homes, 2005-2012

	California nursing homes	Stratified by Number of Beds		Stratified by Staffing		Stratified by Profit Status	
		Small	Large	Low staffing	High staffing	For-Profit	Non-Profit
Nursing Homes	-114.96*** (39.85)	32.89 (41.80)	-235.18*** (50.37)	-195.41*** (50.78)	42.28 (62.25)	-169.46*** (45.44)	41.41 (74.21)

Total net revenue reported in thousands of dollars.
All of the models include year and facility fixed effects. Robust standard errors in parentheses.
*p<0.10 **p<0.05 ***p<0.01

Table 4. Effect of a 1%-point Change in Unemployment on Nurse Staffing Minutes per Resident Day in National Nursing Homes, 2005-2012

	National nursing homes	Stratified by Number of Beds		Stratified by Staffing		Stratified by Profit Status	
		Small	Large	Low staffing	High staffing	For-Profit	Non-Profit
RNs	0.0777 (0.0571)	0.0215 (0.1305)	0.0868 (0.0633)	0.0772 (0.0485)	0.1498 (0.1299)	0.1238* (0.0673)	-0.1529 (0.1049)
LPNs	0.0637 (0.0628)	0.0145 (0.1618)	0.0521 (0.0672)	0.1642** (0.0671)	-0.0378 (0.1272)	0.1492** (0.0742)	-0.2700** (0.1215)
Aides	-0.1608 (0.1170)	-0.2050 (0.3015)	-0.1300 (0.1255)	-0.3523*** (0.1263)	0.0748 (0.2383)	-0.1900 (0.1325)	-0.0065 (0.2617)
Total	-0.0194 (0.1545)	-0.1690 (0.3934)	0.0089 (0.1656)	-0.1110 (0.1513)	0.1868 (0.3373)	0.0860 (0.1751)	-0.4292 (0.3456)
RN/Total	0.0003 (0.0002)	0.0005 (0.0005)	0.0002 (0.0002)	0.0004* (0.0002)	0.0005 (0.0003)	0.0003 (0.0002)	-0.0003 (0.0004)
No. nursing homes	7,637	1,633	6,004	4,707	2,930	5,701	1,936
No. observations	95,068	18,254	76,814	62,323	32,745	71,365	23,703

All of the models include year and nursing home fixed effects. Robust standard errors in parentheses.
*p<0.10 **p<0.05 ***p<0.01

Table 5. Effect of a 1%-point Change in Unemployment on Nurse Staffing Minutes per Resident Day, using alternative specifications to control for time, 2005-2012

	County-specific trends		State-specific trends	State-time dummies
	California Nursing Homes	National Nursing Homes	National Nursing Homes	National Nursing Homes
RNs	-0.2837 (0.3125)	-0.0768 (0.0639)	-0.1291* (0.0688)	-0.1253 (0.0852)
LPNs	-0.2694 (0.3769)	-0.0143 (0.0773)	0.0656 (0.0807)	0.0752 (0.1044)
Aides	-1.0429 (0.6610)	0.0207 (0.1445)	-0.0789 (0.1510)	-0.2703 (0.1943)
Total	-1.5961* (0.8149)	-0.0705 (0.1888)	-0.1424 (0.2000)	-0.3204 (0.2591)
RN/Total	0.0003 (0.0013)	-0.0003 (0.0002)	-0.0004 (0.0002)	<0.0001 (0.0003)
No. nursing homes	1,044	7,637	7,637	7,637
No. observations	8,086	95,068	95,068	95,068

All of the models include nursing home fixed effects. Robust standard errors in parentheses.
*p<0.10 **p<0.05 ***p<0.01

Table 6. Effect of a 1%-point Change in Unemployment on Nurse Staffing Minutes per Resident Day in California Nursing Homes, Weighted by Bedsize, 2005-2012

	California nursing homes	Stratified by Number of Beds		Stratified by Staffing		Stratified by Profit Status	
		Small	Large	Low staffing	High staffing	For-Profit	Non-Profit
RNs	-0.5207* (0.2715)	-0.4282 (0.5143)	-0.5401* (0.3107)	0.1426 (0.2531)	-1.5753*** (0.5892)	-0.3528 (0.2645)	-0.6873 (0.7463)
LPNs	0.6920*** (0.2518)	0.6495 (0.5827)	0.7137* (0.2782)	0.2817 (0.2500)	1.5996*** (0.5255)	0.7158*** (0.2610)	1.1229 (0.9392)
Aides	-0.3263 (0.4140)	-1.0610 (1.2291)	-0.1213 (0.4302)	-0.3753 (0.3090)	-0.0327 (1.0437)	-0.1472 (0.3982)	-1.2885 (1.9251)
Total	-0.1550 (0.6129)	-0.8397 (1.5411)	-0.0523 (0.6664)	0.0490 (0.3800)	-0.0084 (1.5941)	-0.2158 (0.5875)	-0.8529 (2.5054)
RN/Total	-0.0012 (0.0010)	-0.0005 (0.0022)	-0.0014 (0.0012)	0.0012 (0.0012)	-0.0053*** (0.0019)	-0.0009 (0.0011)	-0.0019 (0.0028)
No. nursing homes	1,044	314	730	691	353	904	140
No. observations	8,086	2,388	5,698	5,379	2,707	7,047	1,039

All of the models include year and nursing home fixed effects. Robust standard errors in parentheses.
*p<0.10 **p<0.05 ***p<0.01

Table 7. Alternative Specifications of the Effect of a 1%-point Change in Unemployment on Nurse Staffing Minutes per Resident Day in National Nursing Homes, 2005-2012

	Alternative specifications for national nursing homes					
Aides	-0.0818 (0.1541)	-0.0003 (0.0013)	-0.2663 (0.1994)	-0.0009 (0.0016)	0.0257 (0.1481)	-0.0003 (0.0012)
RNs + LPNs	-0.0331 (0.1094)	-0.0001 (0.0011)	0.0258 (0.1393)	0.0008 (0.0015)	-0.0691 (0.1046)	-0.0012 (0.0011)
Demographic controls	X	X	X	X	X	X
Total number of beds	X	X	X	X	X	X
Logged dependent variable		X		X		X
State-specific trends	X	X				
State-year dummies			X	X		
County-specific trends					X	X

Demographic controls include fraction of the population who are less than 5 years old, 5 to 17 years old, 20 to 29 years old, greater than 65 years old, high school dropouts, with some college, college graduates, black, and Hispanic.
All of the models include nursing home fixed effects.
Models that do not control for time trends include year fixed effects.
Robust standard errors in parentheses.
*p<0.10 **p<0.05 ***p<0.01