A Market for Long-Term Care Beds in Illinois

A Report for the Long-Term Care Subcommittee of the Illinois Health Facilities and Services Review Board

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Executive Summary

The market for long-term care (LTC) services has undergone a pronounced change in the last few decades. Concurrently, disability rates among the elderly have fallen notably in recent decades (Cutler 2001). It is also apparent that preferences related to elder-care have changed as the "aging-in-place" movement has gained considerable momentum leading providers to respond in diverse ways (Grabowski et al. 2012). However, regulation of the LTC industry in Illinois has been largely unchanged since the 1970s. The purpose of this report is to examine the issues related to creating a market for LTC bed licenses in Illinois.

Presently, any substantial changes to LTC bed licenses must be judged against the "need" for such beds in the area using a formula. As a general matter a "bed need formula" such as the one employed in Illinois neither incorporates the cost of delivering care nor is it likely to be a meaningful indicator of the demand for care. Evidence from other states, sectors, and from economic theory suggests that LTC markets will function better with relaxed CON constraints. Thus we conclude that a first-best approach to regulation in Illinois would be to eliminate the CON process, as 14 other states have done. A second-best approach involves allowing nursing homes to buy and sell bed licenses for already approved beds. The key benefits will be more flexible and dynamic adjustment to changing market conditions and a better allocation of beds across geographical areas within the state.

We conclude that a market for LTC beds in Illinois would: 1) improve the distribution of beds statewide; 2) likely lead to movement of beds from high-Medicaid facilities to low Medicaid facilities; 3) there is little evidence to suggest that funds acquired by facilities through bed sales will lead to infrastructure investments or quality improvements; 4) in structuring a bed market, the largest geographic unit (ideally the entire state) should be used for the market, rather than smaller geographic sub-units; and 5) to allow for the most efficient reallocation of beds to meet local demand for nursing home services, the state should exhibit a light touch regarding the regulation of proposed bed sales.

I. Introduction

The market for long-term care (LTC) services has undergone a pronounced change in the last few decades. The population has aged quite rapidly. The costs of providing facility based LTC services and other health services have increased steadily. In many states, Illinois among them, Medicaid reimbursement rates have not kept pace with these changes and are now quite low relative to the rates offered by private paying patients and even Medicare patients. There has also been a considerable increase in the share of the LTC market that is devoted to home and community based care services and general "aging in place" resources.

Throughout all of these changes, some states have chosen to alter they regulatory framework used to manage the LTC markets. Many states have disbanded their Certificate of Need (CON) boards altogether. Others have opted for a variety of partial deregulations or have moved in the other direction by imposed moratoria on the expansions of new LTC beds. Illinois has not pursued these kinds of changes and it has continued to rely on a bed need formula to guide its decisions about the appropriate number and allocation of beds in the state. Recently, the board has expressed some interest in the possibility of creating a market in LTC beds that would allow LTC facilities to buy and sell their existing beds to other facilities in the state. Our team was asked to study this issue and to examine in particular the following questions:

1. Can a bed market improve utilization of existing beds?
2. How might a bed market affect current LT residents and the community, particularly underserved communities?
3. What are the best ways to structure a bed market?
4. Can a bed market infuse capital in LTC institutions?
5. What are potential unintended consequences?

This report summarizes our approach to thinking about these questions in the context of a hypothetical regulated market for LTC beds in Illinois. At the outset, the report gives a short discussion of the scientific literature that is relevant to the issue of CON regulation in the United States. The third section of the report lays out a simple conceptual framework that is based on a stylized microeconomic model of the nursing home market. The model provides a simple way to characterize the likely consequences of different forms of regulation and competition in a market for LTC beds, and it guides our thinking and our overall analytic approach. Although the theoretical framework is a very useful tool, theory is not evidence and we also felt that it was important to pursue a more empirically oriented analysis of the questions posed by the Subcommittee. That work required collecting and combining data from several different sources. In the fourth part of the report, we describe the main sources of data we used in our analysis. A key element of our empirical work is the analysis of Ohio's experience in operating a regulated LTC bed market over the past two decades. We give an overview of the analytical methods we applied to the data in section five. The results of the empirical work are presented in section six. And the final section summarizes the key findings of our analysis and offers some conclusions about the likely consequences of a LTC bed market for Illinois.

II. Policy Context and Previous Literature

There are no published studies examining the effects of LTC bed markets. However, many of the conceptual features relevant to understanding the consequences of entry and quantity regulations are likely to hold in other areas of the health sector, which have been studied in more detail. Although the lessons from these other areas of research may not be directly applicable to the LTC bed market, we think there is sufficient overlap both in terms of the underlying economics and the nature of the regulations to make a review of the literature worthwhile.

Certificate of need (CON) regulations began in response to the "Health Planning Resources Development Act" of 1974. The general motivation was a concern that population and geographically oriented health planning and regulation was necessary to prevent the duplication of services that were being paid for through the cost-based reimbursement systems common at the time. Under the typical CON regulation, hospitals, nursing homes, and other providers are required to obtain approval from a state agency before entering the market or expanding the scale of an existing business. The agency is supposed to approve or deny proposed entrants or expansions by determining whether or not the community actually has a "need" for the new services. In Illinois, the CON board uses a formula to determine the need for LTC beds by combining information about the occupancy rates and empty beds per community-dwelling elderly person. Some states have also enacted construction moratoria that theoretically prevent any expansions or new entrants in the nursing home sector.

Many states have abandoned their CON regulations for hospital and LTC facilities. At present 36 states still have some type of CON regulations in place and 11 states have moratoria on long-term care beds in place. In the academic and public policy literatures, CON programs have largely been discredited as hospital cost control mechanisms. The basic premise of the CON regulation, that it saves money, has never been demonstrated in the scientific literature. On the other hand, CON regulations have been found to increase hospital costs by causing inefficient substitution of non-capital inputs for capital in the production process (Lanning et al. 1991, Salkever 2000).

Other analysts argue that that CON regulations may further increase costs relative to a market oriented model because the unfettered entry of competitors that could occur in a market framework would exert downward pressure on prices. In an important joint report, the Federal Trade Commission and Department of Justice suggested that CON regulations generally served to increase prices and costs by limiting competition (FTC/DOJ 2004). An earlier study found "no evidence of a surge in acquisition of facilities or in costs following removal of [hospital] CON regulations", which again casts doubt on the theory that CON regulations keep a lid on costs (Conover & Sloan 1998). Despite this evidence on prices and costs, a persistent fear among state agencies is that unchecked entry will lead to runaway state Medicaid LTC spending. However, Grabowski et al. (2003) used state-level data from 1981-1998 to study the effect of repealing CON regulations and moratorium laws in the nursing home market. The authors found that such regulatory changes had no effect on

state-level Medicaid spending for LTC services, leading the authors to conclude, "states have little to fear in terms of increased expenditures with the repeal of CON and moratorium laws."

III. Conceptual Framework

In the economics literature, most representations of the LTC market start with the monopolistically competitive model presented by Scanlon (1980). We follow that approach here. Our main goal in adopting the monopolistically competitive model is that it allows us to understand how LTC facilities make decisions about how many beds to fill and how many to leave vacant. In particular, the model provides an analytic framework that retains key economic features of the LTC market while abstracting from much of the complexity that obscures important relationships in the real world. We use the simplified model to understand how bed occupancy is affected by Medicaid reimbursement rates, nursing home cost structure, and CON restrictions on the supply of licensed beds.

Figure 1 displays a simple model of a nursing home market. In this first hypothetical setting, we imagine that the only payer is the state Medicaid program, which offers nursing homes a fixed rate P_M for each patient. The horizontal line starting at the point P_M on the vertical axis represents the amount of revenue that a nursing home will receive from each additional patient that it admits. A key idea is that nursing homes are "price takers" in this market, which means that they cannot influence the price level in any way because the price is set administratively. The other important line on the graph is labeled MC. This represents the marginal cost that the nursing home faces for each additional patient. The line slopes upwards to indicate that the cost associated with caring for additional patients grows as the nursing home adds additional patients. Rising marginal costs is a plausible assumption for most nursing homes and it reflects the fact that adding additional patients requires additional resources that become more costly as the facility scales up. (More patients may require more staff and this can increase managerial complexity, and at some point more patients may require new construction. These changes in costs show up as rising marginal costs.) In a more complete model, it is likely that the full cost function follows a U-shaped curve: initially a home is likely to realize "economies of scale" and decreasing marginal costs, but eventually the marginal returns to adding more labor begin to diminish and the marginal costs begin to increase. We assume that facilities will almost always have expanded to the point after which the low hanging fruit offered by economies of scale has been eaten. And so we draw only the upward sloping part of the curve because that is the situation that most LTC facilities face in the real world.

How does the facility with the cost and revenue structures depicted in Figure 1 decide how many beds to fill? Simple cost benefit reasoning implies that the facility will choose to add patients as long as the cost of an additional patient is less than the revenue it will receive from providing care to the patient. In Figure 1, this breakeven point occurs at the point labeled Q_M on the horizontal axis. A key point is that the home decides on the point Q_M by comparing costs and revenues and it cannot provide care to more than Q_M patients without losing money. This calculation has nothing to do with the actual "capacity" of the facility. If

costs exceed revenue then the nursing home will choose to leave some of its capacity unused. To think about the consequences of changes in the costs of providing LTC services, we have to imagine "shifting" the MC curve. If costs increase then the MC curve will shift to the left in figure 1. Shifting the curve to the left means that the MC curve will cross the revenue curve at an earlier point. Other things equal, a higher cost structure will lead facilities to fill fewer beds. If costs were to decrease, then the MC curve would shift to the right. Lower costs would induce facilities to fill more beds at the breakeven point.

One key message from figure 1 is that the relationship between marginal costs and marginal revenue (Medicaid fees, in this case) determines the number of beds that a facility would like to fill. A second key message is that different facilities may have different cost structures. Other things equal, facilities with higher marginal costs will tend fill fewer beds than facilities with lower marginal costs. Cost structures will often have no connection with the kind of geographically local conditions that CON boards use to determine "need".

Fig. 1: The LTC market, Medicaid only

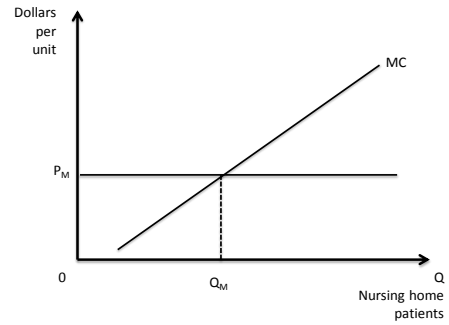


Fig. 2: The LTC market, Medicaid only Plus CON

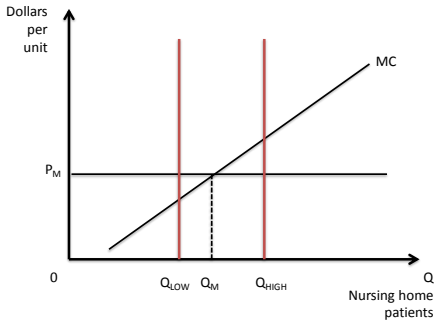


Figure 1 shows how a facility chooses the number of beds to fill in a very simple hypothetical setting in which marginal revenues are flat because Medicaid is the only payer. The real world is obviously far more complicated and several important aspects of the real world are missing from Figure 1. From this point forward, we begin to layer on a few additional institutional details that we think matter in the real world. We still try to keep the conceptual model as simple as possible, however, because our goal is to capture the features of the LTC market that are most salient for thinking about the role of different types of CON regulation, such as active management and managed LTC markets. The first obvious limitation of Figure 1 is that it does not include the behavior of a CON board at all. Instead, it shows what would happen in a basic situation in which there as no CON board interference with the bed filling decisions of LTC facilities.

In Figure 2, we incorporate the CON board more deliberately. Figure 2 shows what happens under two different scenarios regarding CON policy choices. The first setting involves a CON decision to fix the number of beds available to the facility at a particular

level called Q_{HIGH}. What will the facility do in this case? As before, it will attempt to fill beds until the marginal revenue it receives from filling the bed is exactly equal to the marginal costs of filling the bed. That is, the home continues to have Q_M patients as additional patients beyond Q_M yield negative net revenues from the home's perspective. In this situation, the facility has "excess beds" that it will choose not to fill because it would lose money if it did so. (We assume that facilities will not attempt to or be able to borrow money to provide LTC services at an operating loss.) Comparing the vertical line Q_{HIGH} with the breakeven point Q_M gives some insight into why a facility might be interested in selling beds to another facility: it is not using the beds and it might be willing to sell the excess beds at some price.

The second scenario in Figure 2 is depicted by the vertical line Q_{LOW}. In this situation, the current number of licensed beds available to the facility is limited to a level, Q_{LOW}, that is less than the breakeven point Q_M. This constraint is binding for the facility and it is not able to fill as many beds as it would like. The number of filled beds shifts down from Q_M to Q_{LOW}. This home would probably try to apply to the CON board for an approval to expand its number of beds. But if denied the facility would be stuck operating at a sub-optimal scale. If a market in LTC beds were available, the facility might be interested in purchasing beds from another facility. The distance between the revenue curve (P_M) and the marginal cost curve (MC) at points near Q_{LOW} gives us a sense of how much a facility might be willing to pay to purchase more beds since that gap represents the gain that the facility would realize if it could fill a few additional beds.

The key ideas from the simple model with only the presumption of a single payer paying a fixed per diem amount are as follows:

- Nursing homes can justifiably leave beds vacant if the marginal cost of filling an additional bed exceeds the marginal revenue.
- Low occupancy rates do not necessarily indicate low demand for nursing home beds
- Cost structures likely vary across individual nursing homes so that one nursing home may have too many beds at the same time that another home needs more beds
- Cost structures, reimbursement rates, and demand can vary over time so that a nursing home can have too many beds in one year and too few in another
- CON restrictions on the number of beds available may mean that some nursing homes will have too many beds and others will not have enough beds from the perspective of their optimal "break even" point.

The simple model reveals many key behavioral elements of the nursing home market, notably the role of costs, reimbursement rates, and restricted supply can provide an explanation for high versus low occupancy and resolve the apparent paradox of high demand and low occupancy. Nevertheless the simple model ignores the fact that in the real world there are really (at least) two important types of patients: Medicaid and private pay patients.

Fig. 3: A model of the LTC market with private and public pay patients

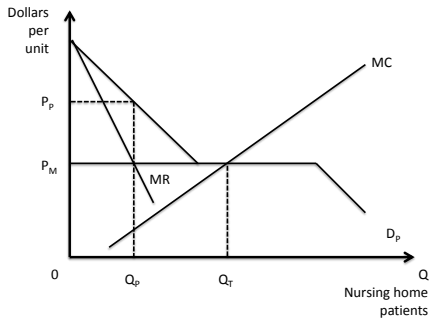


Fig. 4: A model of the LTC market with private and public pay patients, CON

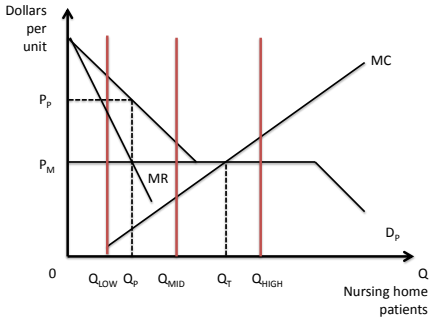


Figure 3 now presents a nursing home market with two types of patients. Adding two types of patients alters the demand and marginal revenue curves that featured in Figures 1 and 2. In Figure 3, the marginal revenue curve is segmented. The first set of patients represents private paying patients and these patients generate a standard downward sloping demand curve for LTC services. At high prices, only a few people are interested in purchasing LTC services. As prices fall, more and more people are willing to purchase LTC services. Eventually, the number of private pay patients is exhausted and the Medicaid payment structure reappears as a horizontal segment. The figure is drawn so that the nursing home takes $0Q_P$ private patients paying P_P[1] and Q_PQ_T public patients up to the point at which the cost of caring for the next patient exceeds the revenue gained from that patient. This model is sometimes called the "excess demand" model and was developed by Scanlon (1980). As before the MC line indicates the rising cost associated with caring for additional patients.

Figure shows three different scenarios for bed limitations each with different implications. Consider first the case in which the home has Q_{HIGH} as the number of licensed beds. As in Figure 2 the home has unused capacity: additional patients are money losers from home's perspective and the home could potentially benefit from selling the excess beds. Alternatively if the home has a limit on beds at Q_{MID} the home could profit from more beds that it would profitably fill with Medicaid patients. In the third scenario, with the number of licensed beds at Q_{LOW} the home could again profit from having more beds licenses, but would prefer to fill them with private patients.

In a market in which the number of bed licenses was chosen many years ago, and cost growth has been high along with no commensurate increase in Medicaid fees, scenario 1 is likely to describe the market for many nursing homes in the state. Depending on how low the Medicaid reimbursement rate is relative to a given nursing home's cost structure, some homes may have exclusively private pay patients. Others might have a mix of private and public patients.

[1] The private pay price P_P is derived under the assumption that the nursing home has a local monopoly in the private pay market. Thus, each additional private pay patient must be acquired by a price reduction for that patient and all private pay patients who came before, leading a more steeply sloped "marginal revenue" (MR)

The key lessons from the model that includes both private pay patients and Medicaid patients are as follows:

- Any changes in cost, demand or reimbursement rates will result in nursing homes having too many or too few beds based on their licenses.
- As in the simple model, the number of bed licenses is largely irrelevant to the nursing home's decision-making about how many beds to fill; bed licenses only matter when the nursing home has too few beds.
- Changes in cost, demand or reimbursement will not affect every nursing home the same way so some nursing homes will have unused beds and others will have too few at the same time.
- Changes in market conditions can affect private pay and Medicaid patients in different ways.

Overall the basic theoretical framework put forward provides a number of important implications, many of which will inform the empirical analyses we describe below. The first is that if cost structures and demand conditions change over time and across nursing homes then there will always be a need for changes in bed allocations. Thus to maintain a "good" allocation of beds, the CON board would need to anticipate and respond to all of these changes. In contrast, a marketplace that allowed nursing homes to buy and sell excess beds would provide a way for the system to adapt to and automatically correct for a wide range of changes in market conditions.

IV. Data

A wide array of data sets were brought together in order to study the Illinois LTC market and model the likely effects of a bed market. First we describe the Online Survey, Certification and Reporting (OSCAR) data that we will use for our main analysis and predictive model of LTC bed buying and selling behavior. These data provide nursing home level data and have been widely used for research purposes. Next we describe the county level Area Health Resource File, which provides important contextual information for our analysis. Lastly we spend some time discussing the State of Ohio, which in 1991 implemented a nursing home bed market and will provide a basis for our predictions about how such a market would affect LTC service delivery in Illinois. We recognize the expression, "you've seen one state, you've seen one state"—meaning that each state has its own idiosyncratic policies and institutional differences such that generalizing the experience of one state to another is a treacherous undertaking. Despite the concern, we believe on net there is much that policy makers in Illinois can learn from Ohio's experience.

A. Online Survey, Certification and Reporting (OSCAR) Data

Our primary data source is the OSCAR data, 1996-2012, for nursing home characteristics of all nursing homes in Ohio and Illinois. The OSCAR database is a compilation of all the data elements collected by surveyors during the inspection survey conducted at nursing

facilities for the purpose of certification for participation in the Medicare and Medicaid programs. OSCAR is the most comprehensive source of facility-level information on the location, operations, patient census and regulatory compliance of nursing facilities. The OSCAR database includes information on nursing homes' occupancy, payer mix, proprietary status, number of beds, hospital affiliation, staffing, case mix, and regulatory deficiencies issued during the three most recent state inspections. The survey inspection results are collected by state survey agencies, whose representatives perform onsite evaluations of each facility at least once every 15 months. The state survey agencies are then responsible for entering survey information into the OSCAR database and providing updates as needed. The information on the nursing homes' characteristics derived from OSCAR is prepared by each nursing home at the beginning of the regular state inspection.

OSCAR data were obtained by the researchers for prior research projects. We merged the OSCAR data with the Ohio transactions data describing nursing home bed sales and purchases, prices, quantities under the buy-and-sell program. The merge was conducted by manually searching in OSCAR for matching facility names and addresses of all nursing homes appearing in the Ohio transactions data.

B. Area Resource File

County level data for Ohio and Illinois was obtained from the Area Resource File (ARF) to characterize the LTC environment for 1999 – 2011 (HRSA 2013). We obtained the total number of skilled nursing facilities (SNFs), the total number of beds in SNF facilities, the number of home health agencies, and the total number of hospital beds allocated to long term care. Additionally we obtained the population size and proportion of the population of the county's population over age 65. The population over age 65 is the primary determinant Ohio uses in determining demand for LTC bed supply. The total number of SNF facilities and SNF beds are restricted to those certified by the Centers for Medicare and Medicaid Services (CMS) for Medicare reimbursement.

C. Ohio Policy Context and Data

We spend some time describing the experience in the state of Ohio because the state created a market for LTC beds in 1991. It is important to recognize that there are notable differences between Ohio and Illinois, and it is not our intention to imply otherwise. We use Ohio's experience to inform our model of the likely effects of a bed market in Illinois for two reasons. First, convenience: Ohio's bed transaction data was readily available from state officials and therefore could be studied for the purposes of our report in an expeditious manner. Second, is that Ohio's experience is really two different bed market models in one: a within-county market was originally implemented in the state, but this was later broadened to allow for cross-county bed sales. Multiple market models are important because they allow us to say more about how Illinois might best structure its market. We draw from the bed license sales data in Ohio to create a predictive model of bed buying and selling behavior. Drawing lessons from Ohio that can be applied to Illinois's bed market design requires that nursing home are motivated by the same basic forces we outlined in the theoretical model above. We believe this is the case. Nevertheless some care

is always warranted when using estimates derived from a setting that likely differs along any number of institutional dimensions including medico-legal, regulatory, and patient and provider norms and preferences.

After the initial implementation of the bed market in 1991, Ohio placed a moratorium on new LTC beds in 1993 to both discourage (perceived) unnecessary construction of facilities and beds and to prevent potential bed shortages in counties where bed needs may grow (Mehidizadeh et al. 2010). The market operated in this manner until 2009 when the market rules were amended to allow facilities to buy and sell to one another across county lines (Mehidizadeh et al. 2010 Ohio Department of Health 2013a, 2013b). Prior to this amendment, the market for tradable LTC beds was constrained to within the county; the only way for a facility to obtain additional beds is to do so by purchasing them from other facilities in the same county.[2] The law ultimately created a statewide marketplace for bed supply so that facilities in counties with an oversupply of LTC nursing home beds can sell to facilities in counties where they is a shortage of beds.

To capture movement in the Ohio LTC bed market, we use an administrative dataset maintained by the Ohio Department of Health. The dataset contains transaction information for 536 transactions that occurred between 1991 and 2013. The data captures the recorded price and quantity of beds sold in each transaction in addition to the name of the buyer and the county where the buyer's facility is located. After the moratorium for new LTC beds went into place in 1993, 95% (n=510) of all LTC bed transactions in Ohio occurred between 1994 and 2013. Sixty-eight percent (n=367) of the transactions occurred between 1994 and 2009. Transactions between 2010 and 2013, when statewide sales were allowed, reflected 27 percent (n=143) of the transactions that occurred between 1991 and 2013.

Because OSCAR data were only available from 1996 forward, earlier years of the Ohio transaction data were also not used for this portion of the analysis. Finally, we merged the combined OSCAR and Ohio data with available years of Area Resource File data for county-level population characteristics such as the percent poverty. The Area Resource File data were merged in using county names in each state.

V. Methods

A. The Flow of Beds Across Geographical Areas

One of the most basic advantages of a market-based LTC bed allocation mechanism is that the market will tend to allocate beds to facilities where the beds have the most value. That is, when one facility finds it too costly or unprofitable to fill one of its beds then it may try to sell the bed to a facility that has already filled all of its beds and believes that filling

[2] Ohio treats counties as the service area for which bed needs are determined. There are 88 counties in Ohio. Comparatively, there are 95 general long-term nursing care planning regions in Illinois within 11 Health Service Areas.

another bed would be worthwhile. In the absence of a market mechanism, changing cost and demand conditions may lead to a situation in which some nursing homes hold too many beds and others hold too few. One implication of this story is that the introduction of a LTC bed market will lead to an initial flurry of bed trading that will help alleviate many of the misallocations that have built up over time. This initial flurry of activity is apt to be followed by a much less volatile market in which facilities make a relatively small number of trades each year in an effort to fine tune the scale and composition of their business in response to small changes in cost structure and demand conditions.

At a very basic level, a LTC bed market will guarantee that some geographical areas will experience a net outflow of beds and other areas will experience a net inflow of bed. This is true because the market will be a closed system within the state and because the CON board will likely continue to artificially cap the total number of beds (the exception being approvals of new bed applications by the Board). But this explanation is a simple accounting identity. A deeper and more important issue is whether the pattern of bed flows in a state will be structured in a way that reflects existing differences across communities.

In some ways, the nature of a market induced re-allocation depends heavily on the extent to which existing CON decisions have created situations in which some facilities have too many beds and others have too few. If there are not very many such situations then the overall re-allocation will be quite small and the market will not change much about the distribution of beds. If the current distribution of beds is far from optimal then a market induced reallocation could be substantial in the short run. The pattern of the re-allocation will also reflect the nature of the status quo CON decisions.

To understand the possibility of bed outflows more clearly, we studied an important aspect of the policy changes in Ohio. Prior to 2010, Ohio only allowed within-county trading in LTC beds. After 2010, LTC facilities were allowed to buy and sell beds across county lines. This change in the Ohio LTC Bed market regulations creates an interesting "natural experiment" that we think is informative about the extent to which CON policy and LTC bed markets may shape the flow of beds across communities. We explored three specific reallocation scenarios.

1. ***Elderly Population Flows*** One possibility is that under the status quo (non-market) model, beds are "stuck" in counties with smaller elderly populations. In this case, a shift to a state wide market might lead to a systematic flow of beds from counties with small elderly population to large populations. Such a change might help alleviate shortages but the benefits would likely be small simply because there would likely be too few beds in small counties to accommodate the needs of large counties. We explore this possibility empirically using data from Ohio.

2. ***Poverty Rate Flows*** A second possibility is that the market induced reallocation of beds led to a situation in which beds flow mainly from disadvantaged areas to affluent areas within the state? Such a change might be concerning for equity reasons. But it would also suggest that the status quo CON policies had systematically limited the number of beds in affluent areas and increased the

number of beds in disadvantaged areas. In that case the reallocation would seem to correct that earlier imbalance. Regardless of the welfare implications of such a hypothetical pattern, we use the data from Ohio to measure the extent to which there really was a systematic flow of beds from poorer to richer counties.

3. ***Initial Stock Flows*** A third bed drain scenario that could occur involves flows based on the existing stock of beds in the counties. Perhaps counties with a large number of beds simply have too many beds relative to the local demand conditions and facility cost constraints. In this situation, the market might lead to a net flow from counties with a large stock of beds to counties with a small stock of beds. Alternatively, it might be the case that prior to the market reform counties with a large stock of beds still had too few beds. In that case, we might expect a flow in the other direction. We examine this scenario using the Ohio data.

Data Structure and Terminology. To organize our analysis of bed flows in Ohio, we created a data set that tracked the total number beds that were bought and sold by any facility within each county by year. We combined this data set with information about each county that we obtained from the Area Resource File (ARF). To help us study bed flows, we borrow some classification schemes used to understand the international balance of payments between countries. To this end, we define a binary variable called (Net Importer) that indicates whether a county was a net importer of beds in a given year. We set this variable equal to 1 if the facilities in the county purchased more beds than it sold in a given year so that trade led to a net increase in the number of beds held by facilities in the county. Otherwise, we set the Net Importer variable to 0. Similarly, we define a second binary variable (Net Exporter) that indicates whether a county was a net exporter of beds in a given year. In this case, we set the Net Exporter variable equal to 1 if the county sold more beds than it purchased in a given year. If the county did not sell more beds than it purchased, then we set the variable to 0. Note that it is possible and quite common for a county to have a static position with respect to beds. This occurs when the county did not change its total number of beds.

A few conceptual points are worth emphasizing. First, these balance of payments metrics are always equal to zero at the level of the entire market. Prior to 2010 (except for cases in which new beds are created) no county was a net importer or a net exporter because trades were only allowed within counties. After 2010 between county trading was allowed and so some counties were net importers and some were net exporters. To understand bed flows, we examined whether some types of counties were more likely to be a net importer or a net exporter once across county trading was allowed. In particular, we structured our analysis around three county level flows that seemed plausible and substantively relevant to the CON board's decision process: flows based on the size of the elderly population, flows based on county level poverty rates, and flows based on the initial stock of beds in a county. To analyze these flows, we stratified the data by county type and computed the prevalence of net importers and net exporters in each stratum.

B. Predictive Model of Bed Buying/Selling Behavior

This section of the empirical analysis was designed to assess the effect of a bed buy-and-sell program at the individual nursing home level, focusing on several primary research questions

- What factors are correlated with whether a nursing home buys or sells a bed?
- Does the behavior of Ohio nursing homes, as reflected in the data, make sense of the theory?
- How does the Ohio experience translate to predictions about Illinois?

To examine these questions, we built a nursing home level predictive analytic model. Our overall approach was to use Ohio's experience to construct a predictive analytic model of bed buying and selling behavior, resulting in an assessment of the main nursing home attributes associated with each behavior and an estimate of the strength of those relationships. We then applied those predictive factors to Illinois nursing homes, adjusting for key ways in which Illinois homes and populations differ from Ohio's. The key output from the model is a "predicted probability" that a nursing home would buy or sell a bed. Finally, we calculate specific predicted probabilities of facility types wanting to buy or sell beds (and how many) annually in Illinois.

In addition to this main analysis, we assess whether nursing homes that sold beds exhibited subsequent changes in terms of quality, staffing, or payer mix. We also conduct several robustness checks.

Dependent Variables (Outcomes). We consider three primary dependent or outcome variables to examine the correlates of buy and sell behavior, based on the Ohio transactions data: 1) a dichotomous indicator of whether or not a nursing home bought beds in a given year; 2) a dichotomous indicator of whether or not a nursing home sold beds in a given year; and 3) a continuous measure of the number of beds transacted. The continuous measure was constructed using positive values for beds purchased and negative values for beds sold, so that the combined measure reflects a net change in the number of beds. Using the continuous measure allows us to examine buying and selling behavior in a single model.

To assess whether nursing homes that sold beds exhibited subsequent changes we defined outcomes reflecting quality, staffing, and payer mix. We defined quality as the number of regulatory deficiencies cited during the next OSCAR survey. We defined staffing in two ways, using OSCAR data: the total nursing hours per resident-day and total registered nurse (RN) hours per resident-day. Finally, we used OSCAR data to calculate three different variables reflecting the percent of a nursing home's residents (at the time of the OSCAR survey) whose stay was reimbursed by Medicare, Medicaid, and other (largely private-pay).

Independent variables (predictors). We constructed a number of variables that theory tells us might be related to a nursing home's propensity to buy or sell beds.

- Very high occupancy (>95%)
- High occupancy (90-95%)
- Low occupancy (<85%)
- Total number of beds
- For-profit/Nonprofit
- Whether hospital-based
- Whether part of a CCRC
- Whether part of a chain
- Whether located in an urban area
- Percent of Residents on Medicaid-funded stay
- Percent of Residents on Medicare-funded stay
- Percent of Residents on private pay
- High competition area (23 or more facilities in the county)
- Total number of deficiencies (as a proxy for quality)
- Whether located in an area with high poverty (included in some models)

The vast majority of these independent variables were constructed from the OSCAR data at the nursing home level. High competition was constructed from OSCAR data but was aggregated to the county level; the high competition indicator was set to 1 for any nursing home in a county with 23 or more nursing homes (the median number of homes per county) and zero otherwise. The percent poverty is from the Area Resource File and is measured at the county level. Table 1 describes our sample and these characteristics for Illinois and Ohio nursing homes.

Analytic Approach. Descriptive analysis included calculations of the overall probability of buying or selling in a given year and calculations of the coefficient of variation in occupancy rates in Ohio and Illinois. The coefficient of variation is the standard deviation divided by the mean of a variable (occupancy rate) and reflects how much variation or spread there is within a state. If a state has a high degree of variation in occupancy, it may reflect a less than optimal distribution of beds.

For our main model assessing predictors of buying and selling behavior in Ohio, we use ordinary least squares regression, regressing each outcome separately (buy, sell, and the continuous measure of the number of beds transacted) on the entire list of predictors, plus indicators for each year of our data to control for secular trends. Thus, the association of each predictor with the outcome is estimated holding all other included factors constant.

The models used a lagged structure such that a nursing home's characteristics in a given year will be used to predict buy and sell behavior in the next year, not simultaneously. Use of the lagged values ensures that we measure the attributes before the buy and sell behavior and minimizes the potential for reverse causality, as we do not have specific dates for the buy and sell transactions.

Table 1. Description of the Sample: Nursing Homes in Ohio and Illinois, 1996-2012

	Ohio		Illinois	
Variable	Mean or Percent	Std. Dev.	Mean or Percent	Std. Dev.
Occupancy rate	79.9	22.0	75.0	20.6
Very high occupancy	22.1%		11.3%	
High occupancy	18.9%		15.1%	
Low Occupancy	43.7%		59.3%	
Percent Medicare	13.9	18.7	16.8	24.9
Percent Medicaid	62.2	23.8	55.1	28.6
Hospital Based	5.8%		8.9%	
Number of Deficiencies	5.0	4.9	5.4	5.0
Urban	70.8%		61.2%	
For Profit	74.6%		67.3%	
Not for Profit	22.5%		28.0%	
Chain	56.3%		46.1%	
CCRC	10.4%		6.5%	
Total Bed Size	109.7	76.5	127.3	76.1
High Competition Area (more than 23 beds in the county)	54.3%		51.5%	
Number of facilities	1363		1141	
Number of observations 1996-2012	14444		12917	

To predict the probabilities of each outcome for Illinois nursing homes, we apply the coefficients from the Ohio regression models, but allow the actual values of each predictor to be different in Illinois. For example, if very high occupancy nursing homes have a .01 lower probability of selling beds than the reference category according to the Ohio model, the Illinois predictions will also assume that very high occupancy nursing homes have a .01 lower probability of selling beds. However, the predictions will take into account that the likelihood of being very high occupancy in Illinois is different than in Ohio.

To aid in interpretation and give more concrete examples of how predicted buying and selling differ for different types of nursing homes, we calculate the predicted probabilities for subsets of the data representing stylized "types" of nursing homes that may be of interest.

For our models assessing whether nursing homes that sold beds exhibited subsequent changes in quality, staffing, or payer mix, we estimated nursing home fixed-effect regressions. Fixed-effect regressions use only the within-nursing-home changes over time to estimate the relationship between selling beds and our outcomes of interest, netting out the nursing home attributes that do not change over time. This allows us to better isolate changes due to the sale of beds and not to spurious causes associated with facility types.

We again include indicators for each year to control for secular trends. For these models, the lag structure is such that a sale of beds in one year is used to predict outcomes in the next year.

VI. Results

A. Ohio Descriptive Analysis of LTC Bed Sale Transaction Data

We first present descriptive information from the Ohio bed sales data as these data play an important role in our predictions regarding the likely effects of a bed market in Illinois. All prices are presented in 2013 dollars for comparability across years. Transactions are defined as a transfer of LTC beds between one buyer and one other seller for a determined price for each bed either through the purchase of a license for a new LTC bed, an intra – corporation relocation, or an approved renovation/replacement project (see Table 2). Additionally, facilities may lease the rights to a LTC bed for a predetermined period. The most frequent type of transaction between LTC facilities in Ohio's LTC care market during the study period is for the outright purchase of bed licenses from other facilities.

Table 2. Types of Long Term Care (LTC) Transactions in Ohio, 1991 – 2010 (n=536).

	Frequency	Percent of Total
Purchase	470	87.6
Relocation	42	7.84
Lease	15	2.80
Renovation/Replacement	9	1.68

1994 is the first year of the moratorium for new LTC beds in Ohio and shortly after, the average sale price for a bed in intra-country transactions occurs in 1996 peaks at $29,400. During 1996, there were five total transactions—substantially fewer than the 21 transactions in 1994. At the time of the amendment to the CON law in 2009, the average price for the sale price for a bed was $18,400 and there were 40 approved applications for new. In the following year, the year after the intra-county restriction is lifted on the market for LTC beds in Ohio, there is a 115 percent increase in the number of transactions between buyers and sellers, while there is also a 47 percent decrease in the average sale price for a bed license (see Figure 5). The new average sale price for a LTC bed license is around $9,700, and there were 86 total transactions, that resulted in the license transfers to more than 1,800 LTC beds in Ohio. (The appendix table contains detailed sales information.)

Figure 6 displays the average sale price per LTC bed and the average number of beds involved in each transaction from 1991 to 2013. As highlighted in Figure 5, the peak in the average sale price per bed peaks in 1996; however we also notice the sharp decline in the

Figure 5. Total Number of LTC Bed Transactions and Average Sale Price per Bed, 1991 – 2013.

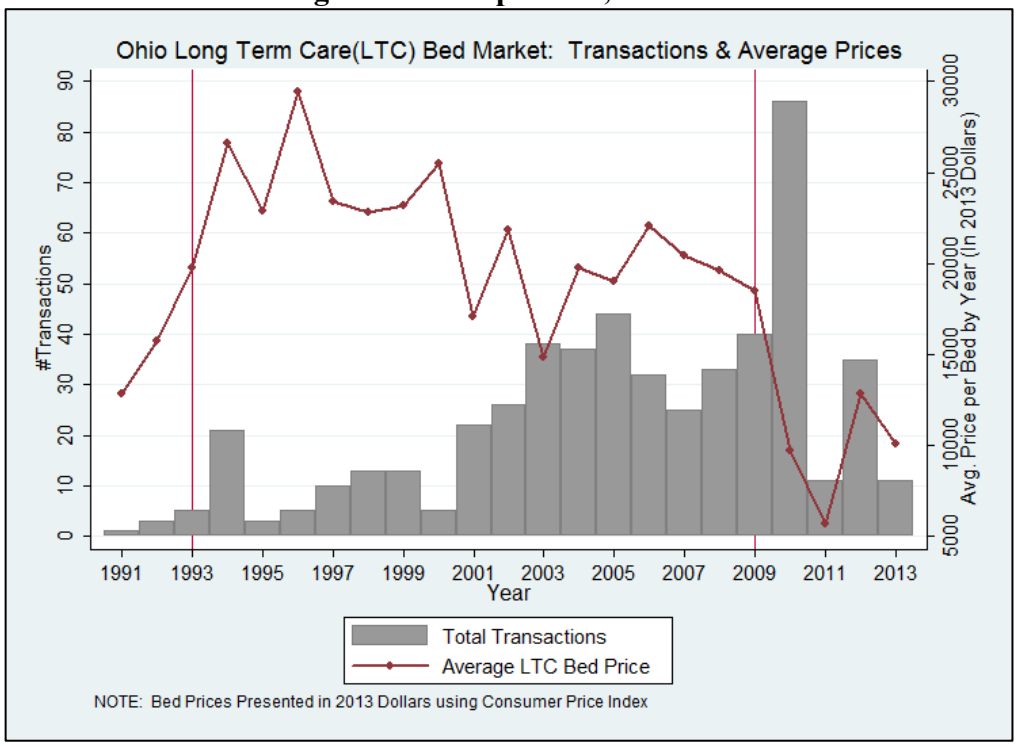
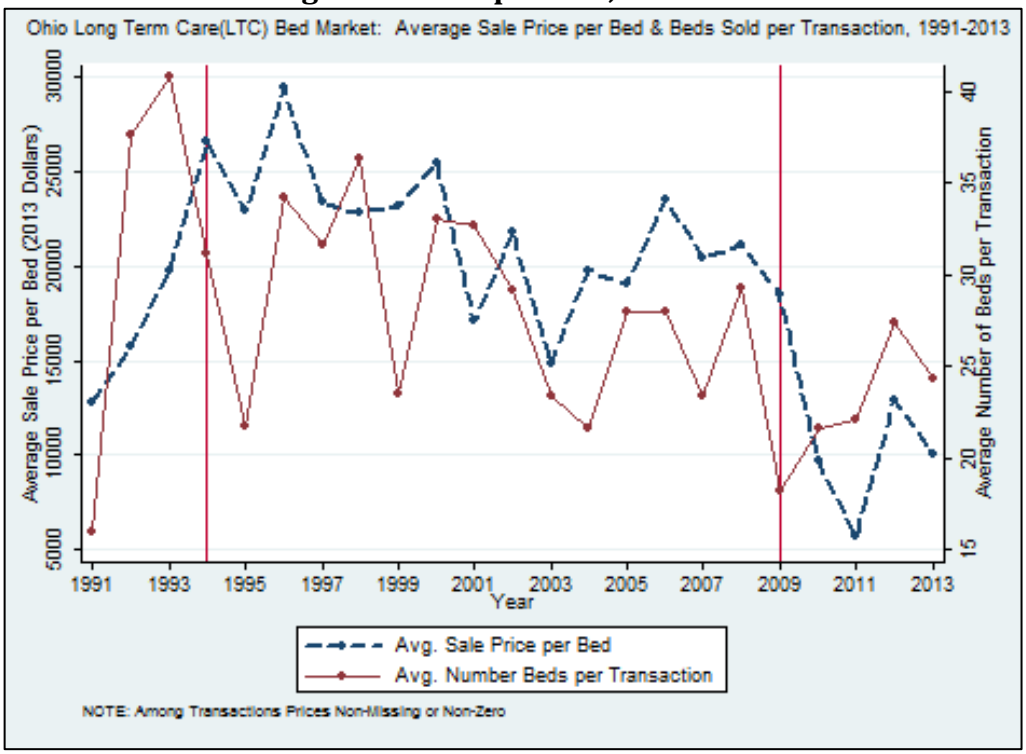


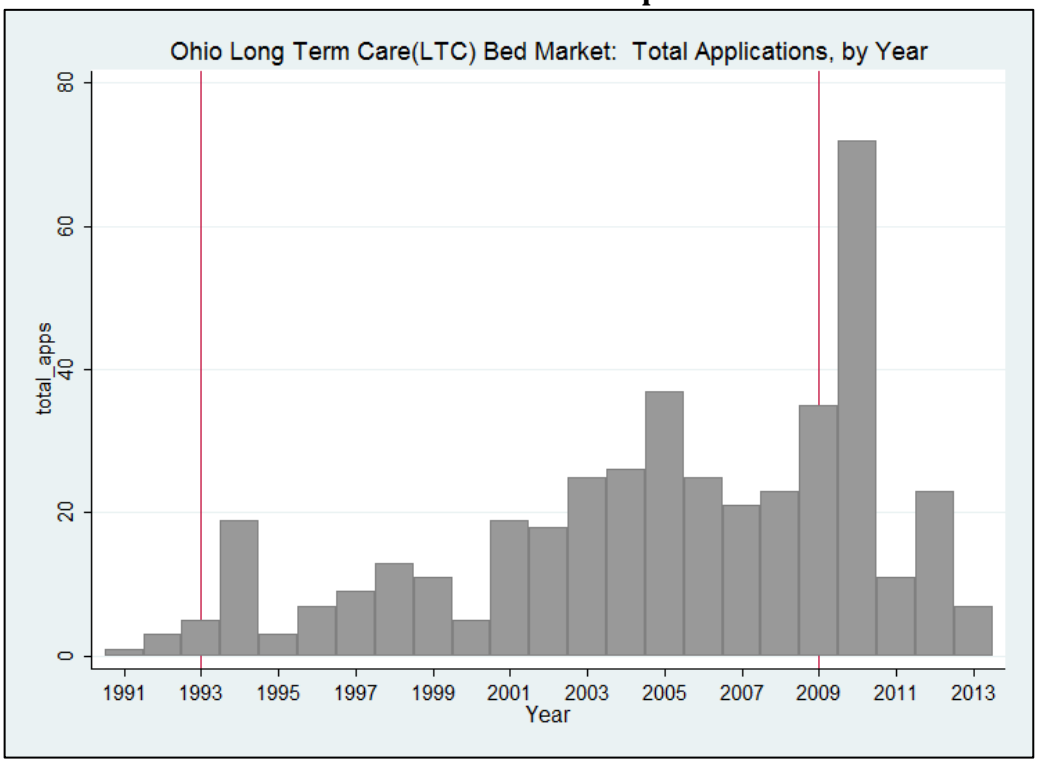
Figure 6. Average Number of LTC Beds sold per Transaction and Average Sale Price per Bed, 1991 – 2013.



average number of beds involved in each transaction—therefore showing smaller capital expenditures occurring once the moratorium is enacted. In the year following the statewide expansion of the LTC market, the average sale price for a bed license fell while the number of beds per transaction increased in 2010-2012.

In Figure 7 we track the total number of applications for the buying and selling of beds in Ohio's LTC bed market. In the year after the expansion, the number of approved applications for transferring beds increased 105 percent from 35 in 2009 to 72 in 2010. The implication of the large increase in the number of transaction in 2010 is highly suggestive. Apparently there was high demand for more beds that was not being met with the within-county limitation being enforced between 1991 and 2009.

Figure 7. Total Number of Approved Applications for LTC Bed Market Participation



B. The Flow of Beds Across Geographical Areas

To try to understand the extent to which a shift to a market based allocation of LTC beds would lead beds to flow systematically from some types of communities to others, we focused our attention on what happened in Ohio in 2010. As described above, before 2010, Ohio did not permit facilities to trade beds across county lines. After 2010, trading was allowed across counties. Figure 5 reveals that the policy change led to a sudden spike in the number of bed transactions in the entire state, which suggests that the statewide market led to a substantial reallocation of beds that probably alleviated some of the misallocations that had built up over time. After the initial surge, the frequency of trades fell back to a more typical level. To understand the extent to which the market could lead to systematic

and substantial changes in the way that beds are allocated across states, we studied the prevalence of net importing and net exporting counties within specific types of counties.

Elderly Population Size. To examine whether beds were reallocated from counties in ways the reflect the size of the elderly population, we grouped counties into 5 quintiles based on the number of people living in the county who were over 65. Figure 5 shows that there was a substantial spike in transactions in 2010. This is the year when most of the reallocation in beds occurred in Ohio because it was the first year in which the state allowed beds to be traded across county lines. We stratified the sample of counties from 2010 in Ohio and calculated the fraction of these counties that were net importers and net exporters in that year. Table 3 reports the results. The basic question here is whether counties with larger vs smaller elderly populations will be more likely to be net importers or net exporters. The estimates in the table suggest that there was not a systematic flow of beds according to elderly population size at the county level. For example, about 17% of counties with very small elderly populations in the range of 1200-4600 people were net importers of beds, and about 22% of such counties were net exporters of beds. Similarly, in counties with very large elderly populations in the range of 22,000-1.6M people about 18% were net importers and about 24% were net exporters. The propensity to be a net importer or a net exporter is nearly identical across counties with different numbers of elderly people. Medium sized counties with about 6500-10,000 elderly people had more total trading. But still about the same fraction of counties were both net importers and net exporters. The evidence in Table 3 suggests that beds did not disproportionately flow from small to large counties based.

Table 3. Cross County Bed Flows By Elderly Population Size In the 2010 Ohio Reallocation

Quintile Group	Elderly Population Size Range	Number of Counties	Fraction of Counties That Were Net Importers In 2010	Fraction of Counties That Were Net Exporters in 2010
1	1,221 to 4,658	18	0.17	0.22
2	4,680 to 6,428	18	0.11	0.11
3	6,469 to 9,717	17	0.35	0.29
4	10,520 to 21,998	18	0.17	0.17
5	22,087 to 1,622,015	17	0.18	0.24

Bed Flows Based On County Level Poverty Rates. A key issue is whether the shift to allow a statewide LTC bed market would lead to a situation in which beds systematically flowed out of high poverty counties and into low poverty counties. The large reallocation of beds that occurred after the 2010 policy reform in Ohio presented a good opportunity to study the problem directly. We grouped the counties into quintiles based on the county level poverty rate. The first quintile category contained the 20% of counties with the lowest poverty rates in the state. These counties had poverty rates between 4.5% and 11.2%. The

fifth quintile contained the 20% of counties with the highest poverty rates. In this category the county poverty rates ranged from 19.1% to 35%. After classifying the counties in this way, we stratified the data by poverty quintile and computed the percentage of counties in each poverty quintile that were net importers and net exporters of beds during the surge of trading that occurred in 2010. Table 4 reports statistics from that work.

We found very little evidence that there was a systematic exodus of beds from the poor counties to more affluent counties. For example, 17% of the counties in the first (low poverty) quintile were net importers of beds and about 33% of these low poverty counties were actually net exporters of beds. This means that counties with low poverty rates were actually more likely to export beds than import them. In comparison, in the fifth (high poverty) quintile, about 18% of the counties were net importers and about 12% were net exporters so that high poverty counties were slightly more likely to gain beds than lose beds during the 2010 market based reallocation. It is also worth noting that a sizable fraction of both high and low poverty counties did not experience a net change in the number of beds: they stood pat during the 2010 reallocation. The counties where beds were traded most actively in both directions were the middle poverty counties in the second and fourth quintiles. Overall table 4 implies that there was no obvious geographic-economic gradient in the reallocation of beds that occurred in 2010. This result fits well with the theoretical model we laid out earlier in the report, which suggested that decisions about how many beds are needed are taken mainly at the facility level and facilities in the same county may have very different needs when it comes to the stock of beds.

Table 4: Cross County Bed Flows By Poverty Rates In the 2010 Ohio Reallocation

Quintile Group	Poverty Range	Number of Counties	Fraction of Counties That Were Net Importers In 2010	Fraction of Counties That Were Net Exporters in 2010
1	4.5-11.2	18	0.17	0.33
2	11.3-14.5	19	0.26	0.32
3	14.6-16.8	17	0.06	0.12
4	17-18.9	17	0.29	0.12
5	19.1-35	17	0.18	0.12

Bed Flows Based on the Initial Stock of Beds. The third bed flow hypothesis that we examined revolved around the possibility that the exiting stock of beds in a county might create a geographical pattern in the flow of beds. To study this issue, we grouped counties into categories based on the total number of Skilled Nursing Facility beds that were available in the county. Then we stratified the data with respect to these categories can calculated the proportion of counties in each strata that were net importers and net exporters of beds. These results are reported in Table 5.

The results here are interesting. Among counties with fewer than 250 beds, only 6% were net importers of beds. In addition, about 25% of these small scale counties were net exporters of beds. Together, these points suggest that counties with very few beds may consist of facilities that actually still possess too many beds. The story is almost totally reversed among counties with 250 to 350 beds. About 31% of these counties were net importers of beds in the 2010 reallocation. And only 6% of them were net exporters. This simple evidence suggests that before the reform, Ohio had too many beds in counties that had a small number of beds and too few beds in the slightly larger scale counties. The market helped alleviate this problem. At the higher end of the distribution, in counties where the initial stock of beds exceeded 350 beds, the major geographical flows are slightly less striking. In the 350-600 beds strata, counties were equally likely to be net importers as net exporters. In the larger and very large categories, there were substantial fractions of net importing and net exporting counties. On balance, however the large scale counties were more likely to be net exporters than net importers.

Table 5: Cross County Bed Flows By Initial Stock of Beds In the 2010 Ohio Reallocation

Stock of Beds	Number of Counties	Fraction of Counties That Were Net Importers In 2010	Fraction of Counties That Were Net Exporters in 2010
Less than 250	16	0.06	0.25
250-350	16	0.31	0.06
350-600	23	0.22	0.22
600-1000	14	0.21	0.29
More than 1000	19	0.16	0.21

B. Ohio and Illinois: Key Descriptive Results

Based on our analysis of coefficients of variation, we found a much higher degree of variation in nursing home occupancy rates in Illinois than in Ohio in 2012. The coefficient of variation is 0.27 in Illinois vs. 0.17 in Ohio, i.e. the variation in occupancy from nursing home to nursing home is more than 50% greater in Illinois than in Ohio. This is consistent with a better distribution of bed supply in Ohio after more than a decade of policies allowing the purchase and sale of beds. It indicates that supply and demand may not be well matched under the current approach in Illinois.

Another key result from our basic descriptive analysis was that buying and selling beds is a relatively infrequent event. In an average year, only 2-4% of nursing homes in Ohio were engaged in trading beds. There is no activity for the vast majority of nursing homes on average.

C. Key Results from the Multivariable Regression Models

Regression results from our main models regressing the probability of buying, selling, and the net beds transacted on nursing home characteristics are shown in Table 6. These models are based on Ohio data only.

Table 6. Regressions of Probability of Buying, Probability of Selling, and Net Number of Beds Transacted on Characteristics of Ohio Nursing Homes, 1996-2012

	Probability of buying	Probability of selling	Net Number of Beds Transacted
Very high occupancy	0.000	-0.010	0.381
	(0.04)	(2.69)**	(2.19)*
High occupancy	-0.004	-0.005	0.274
	(1.16)	(1.19)	(1.53)
Low occupancy	-0.004	0.012	-0.397
	(1.24)	(3.69)**	(2.53)*
Percent Medicare	-0.000	-0.000	0.003
	(1.35)	(1.36)	(0.65)
Percent Medicaid	-0.000	0.000	-0.021
	(4.97)**	(5.24)**	(6.15)**
Hospital based	-0.019	0.029	-1.502
	(3.15)**	(4.02)**	(4.42)**
Number of deficiencies	-0.001	0.000	-0.048
	(3.04)**	(1.31)	(4.39)**
Urban	0.004	0.006	-0.111
	(1.60)	(1.97)*	(0.79)
For profit	0.008	-0.010	0.856
	(1.39)	(1.45)	(2.61)**
Not for profit	0.010	-0.007	0.605
	(1.56)	(1.02)	(1.80)
Chain	0.002	-0.002	0.002
	(0.89)	(1.01)	(0.02)
CCRC	0.007	0.001	-0.003
	(1.95)	(0.16)	(0.01)
Total bed size	0.000	0.000	-0.001
	(0.21)	(1.28)	(1.62)
High competition area	0.003	0.010	-0.158
	(1.51)	(3.52)**	(1.24)
Constant	0.018	-0.021	1.110
	(2.14)*	(2.17)*	(2.41)*
R^2	0.01	0.02	0.01
N	14,440	14,440	14,440

Notes: Regression also controls for time (year) effects. * $p<0.05$; ** $p<0.01$

Factors significantly associated with a higher probability of buying nursing home beds are having a low percent Medicaid (or higher percent private-pay, the reference group), not being hospital based, and being of higher quality as measured by fewer regulatory deficiencies. Factors associated with a higher probability of selling nursing home beds are having low occupancy (and not having very high occupancy), having a higher percent Medicaid, being hospital-based, and being located in an urban or high-competition area.

The regressions of the net number of beds transacted combine the probabilities of buying and selling and also take into account the volume of the transactions. In this regression, the results reveal that nursing homes with very high occupancy were more likely to increase beds and those with low occupancy were more likely to decrease beds; nursing homes with more Medicaid residents were more likely to decrease beds and those with more private-pay were likely to increase; hospital-based and lower quality nursing homes were likely to decrease net beds; and for-profit nursing homes were more likely to increase beds.

Overall, the results are consistent with the theoretical model. Nursing homes that want to expand are those that are more likely to be in a situation where the incremental revenues from expanding outweigh the incremental costs: those that have a more advantageous payer mix, are higher occupancy, and of higher quality.

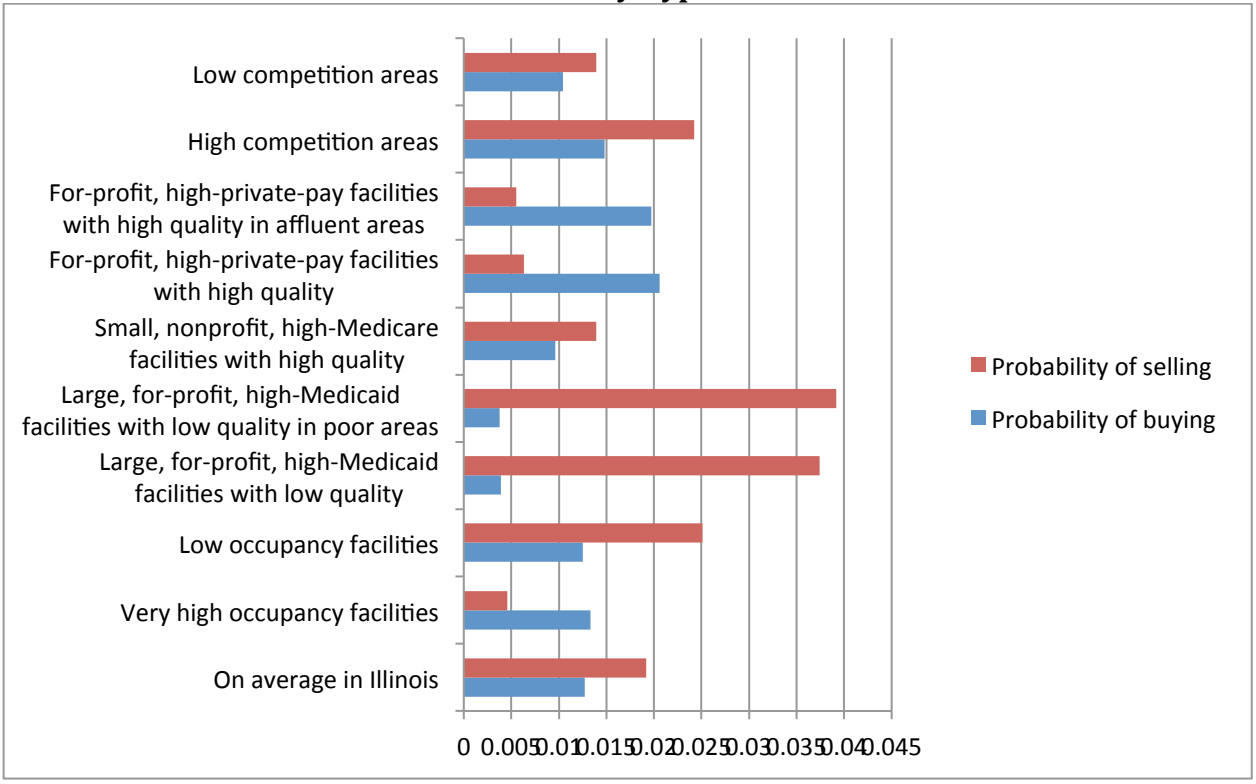
Because we used ordinary least squares, the coefficients can be interpreted as the estimated change in the outcome for a one-unit change in the independent variable, e.g. hospital-based nursing homes are associated with a 0.019 decreased probability of buying beds. Even the statistically significant effects are generally small in magnitude, indicating that these factors do not explain a large proportion of the variation. Idiosyncratic or unmeasured aspects of the market conditions or individual nursing homes' business models likely play important roles.

D. Predictions for Illinois Nursing Homes

To aid in interpretation, Figure 8 depicts the probabilities of buying and selling among Illinois nursing homes of various types. In applying the estimates from the Ohio model to Illinois nursing homes, one important result is that the overall predicted probability of buying beds is lower, and the predicted probability of selling is higher, in Illinois than in Ohio. This is because nursing homes in Illinois have larger proportions of the attributes associated with wanting to sell as opposed to buy. This is consistent with the fact that Medicaid rates in Illinois are lower than in Ohio, making each bed worth less than in Ohio on average. The main implication of this difference between the two states is that the price per bed under a buy/sell policy will likely be lower in Illinois than in Ohio.

In addition to the overall predicted probabilities, several comparisons are of particular note. The most striking differences between the probability of buying and selling are among the large, for-profit, high-Medicaid facilities with low quality (much more likely to sell than buy) and the for-profit, high-private-pay facilities with high quality (much more likely to buy than to sell). Furthermore, adding the level of poverty or affluence in the county (non-significant when added to the regressions) makes little difference in the predictions. In other words, knowing that a nursing home is high or low Medicaid and high or low quality tells us what we need to know, and adding the poverty level of the surrounding county is superfluous.

Figure 8. Graph of Predicted Probabilities of Buying and Selling for Examples of Facility Types



E. Additional Specifications and Robustness Checks

We conducted several complementary analyses to assess the robustness of our results to different definitions and assumptions:

Definition of buying and selling. The results presented in this section are based on true sales and purchases. However, the Ohio policy also allowed for the leasing and relocation of beds. If we expand the definition of buying and selling to include leases and relocations, our results are qualitatively similar to our main results in terms of the main predictors. However, the magnitudes of effect become a little smaller and noisier, potentially reflecting the fact that leases and relocations involve less certainty and commitment.

Testing effects before and after between-county transactions were allowed. Prior to 2010, Ohio allowed only within-county transactions; starting in 2010 transactions were allowed across county lines. To test whether allowing for this change made a difference in our results, we ran models including interaction terms between our predictors and an indicator for 2010 and later. These models revealed that, although the volume of transactions increased after 2010, the main predictors of buying and selling behavior remained fairly constant.

Nonlinear models. In our main specification, we used ordinary least squares regressions to estimate effects on the probability of buying or selling a bed, where the dependent

variables were dichotomous indicators (yes/no). This type of model is known as a linear probability model. Because linear probability models can be subject to bias in both the magnitudes of effects and the standard errors, we also ran nonlinear (logit) models and found that our results were similar in terms of the main predictors and their statistical significance. Thus, we present the linear probability models because they are substantially easier to interpret.

VII. Recommendations and Conclusion

This section discusses what we have learned from the prior literature, our theoretical model, and the empirical investigation motivated by Ohio's experience with a bed as simulated in Illinois. We consider each of the questions asked of the research team in turn.

1. *Would a bed market improve the utilization of existing beds?*

Our empirical evidence points strongly to yes. First, our theoretical model provides a strong justification on principle for a better bed distribution if buying and selling were allowed. Second, our basic descriptive results showing large surges in transaction activity in Ohio after the policy changes indicate that there was an imbalance in the allocation of beds prior to allowing the sale and purchase of beds. Third, the comparison of variation in occupancy rates between Illinois and Ohio indicates that supply and demand of nursing home beds in Illinois may be substantially imbalanced and that a more efficient allocation could be achieved through a bed market. Thus, both the theoretical model and our empirical results are consistent with improvements in utilization of existing beds.

2. *How will a bed market affect low-income and underserved?*

Economic theory and our empirical evidence suggest that beds can flow to settings with un-served demand by Medicaid patients. However, low-Medicaid facilities are more likely to want to expand, such that large expansions of Medicaid beds seem unlikely. High-Medicaid nursing homes are more likely to want to sell, but under the status quo, unprofitable beds will sit unused in any case. Thus, our evidence suggests that beds do not "flee" low-income areas, and access to nursing home beds by underserved individuals is unlikely to be substantially impacted (positively or negatively) by a bed market.

3. *What can we infer about bed prices in Illinois?*

There are reasons to expect that bed prices will be lower in Illinois than those observed in Ohio. First, there is not a moratorium on new beds. Thus, nursing home could petition the CON board for additional beds. From a bed market perspective the availability of "new" beds will serve to increase the supply of beds in the state and thus reduce the market price of beds. Second, Medicaid reimbursement in IL is the lowest in the nation. Our model shows the important role that the Medicaid reimbursement rate has in influencing the extent to which nursing will experience excess demand for beds: a low Medicaid payment rate will make it more likely that homes want to sell rather than buy. Finally, our predictive model

showed that there is likely to be greater *selling* pressure in Illinois versus Ohio, leading us to expect lower transaction prices as a greater number of sellers signals a buyer's market.

4. Will low-quality nursing homes expand?

A potential unintended consequence of a bed market might be expansion by low-quality nursing homes. This could be the case if providing low-quality care were profitable, perhaps in less competitive markets where occupancy was high due to lack of alternatives. However, our empirical results suggest the opposite. High-quality facilities were more likely to buy beds and low-quality facilities were more likely to sell them. In Ohio, only 1% of purchase transactions involved purchase by a lower-quality facility, defined as being in the top quartile of number of deficiencies. In addition, less than 1% of purchase transactions involved purchase by high Medicaid facilities.

5. Will nursing homes use the funds from a sale for quality improvement?

We cannot answer this directly given current data sources, as we do not have data on direct capital investments or allocation of resources. However, we were able to estimate empirically whether the sale of beds was followed by an improvement in quality (lower deficiencies), total staffing, or RN staffing, relative to nursing homes that did not sell beds. In addition, we used the same fixed-effect regression model (described in the methods section) to estimate whether a sale of beds led to subsequent changes in payer mix.

The results of these regression models are displayed in Table 7. The main coefficient of interest is that on the "sold beds" variable indicating a sale for that nursing home in the prior year. None of the effects tested is statistically significant. Thus, we have no evidence that the sale of beds led to an improvement in quality or to a change in payer mix, but we cannot rule out that there were other, perhaps more direct, consequences. We also did not find significant results when we changed the specification to allow for longer-term effects, examining our outcomes over several years after a bed sale.

Table 7. Facility Fixed-Effect Regressions of Quality-Related Outcomes and Payer Mix on Prior Sale of Beds in Ohio Nursing Homes, 1996-2012

	Number of deficiencies	Total nursing hours per resident-day	RN hours per resident-day	Percent Medicare	Percent Medicaid	Percent Other (Private-Pay)
Sold beds	0.211	-0.005	0.010	0.094	-0.956	0.862
	(0.65)	(0.04)	(0.24)	(0.16)	(1.42)	(1.31)
Constant	6.557	4.058	0.810	11.211	62.028	26.762
	(3.24)**	(5.16)**	(3.07)**	(3.11)**	(14.74)**	(6.53)**
R^2	0.01	0.00	0.01	0.02	0.00	0.01
N	13,078	13,078	13,078	13,078	13,078	13,078

Notes: regression models control for time (year) effects. * $p<0.05$; ** $p<0.01$

Although our results in terms of this question are not conclusive, a lack of significant changes after a sale is perhaps not surprising. Given the prices per bed that emerged in Ohio, the influx of resources from a sale was perhaps not large enough to make a substantial difference. In addition, because the sale is a one-time event, the influx of resources may not affect decisions about ongoing operating expenses such as staffing. Finally, on a conceptual level, a bed market seems a particularly inefficient means of improving capital stock and we might not find effects on the capital stock even if we had measures for it. Expenditures are fungible, and nursing homes will allocate resources to whichever type of expenditure improves the overall financial outlook – if investments in capital are required as part of a sale, the funds may simply be reallocated from other types of spending. Moreover, as noted above, there are some reasons to expect that bed prices will be lower in Illinois than Ohio. The main advantages of a bed market lie not in providing resources to facilities that sell but rather in achieving a more efficient matching of supply and demand such that the allocation of beds is improved, which may improve overall quality by allowing expansion of high-quality facilities.

6. *The best ways to structure a bed market*

Several themes emerge from our theoretical and empirical work that speak to the best ways a bed market should be structured. First, the largest geographic unit, ideally the whole state, is recommended for the market. As observed when statewide exchange was allowed in Ohio, smaller geographic units allowed persistent regional (county) imbalances as evidenced by the flurry of sale activity immediately following the removal of the within county transaction restriction. Moreover, the drop in the market price of beds following the removal of the within county transaction restriction also signals that the bed market was able to more efficiently match buyers and sellers of beds. If the aim is facilitate meeting the market demand with a (largely) fixed set of beds, then efforts to replicate the existing CON application process for sales would only prevent the reallocation from occurring. That is, the Board should allow the bed market to function, and avoid efforts to impede its function through additional fees, rules, and review processes regarding proposed bed sales.

7. *Potential unintended consequences*

It is important to bear in mind that creating a market for a good whose scarcity is wholly artificial creates winners and losers. That is to say, any demand for beds in a bed market indicates the presence of an inefficiency borne wholly from the fact that the state does not allow nursing homes to freely act as they choose. This very reason is why we maintain that the first-best solution is for the state to eliminate CON review. Absent the elimination of the CON review process, in a bed market the state must make its peace with some nursing homes who by historical accident, prescient planning, or blind luck find themselves in possession of more beds than they need and thus potentially a monetary reward in selling those beds. Make no mistake that any price of a bed on the open market greater than zero serves to impede the redistribution of LTC beds to better meet demand by residents.

There is also the potential worry regarding “thin markets”; that is, few buyers (or sellers) in the market. Given the already noted low Medicaid reimbursement rate in Illinois, it is

possible that few nursing homes will be interested in buying beds. Theoretically such a situation would exist if many or all of the nursing homes in the state have excess capacity relative to their number of licensed beds. Nevertheless, this situation is somewhat unlikely as the Board continues to receive applications from homes seeking to build new facilities or expand old ones. The existence of such interest suggests a latent demand for beds that will create a bed market.

The other extreme is that that there may be too few sellers in the market. Too few sellers might occur if facilities hoard beds out of uncertainty with future demand for services or regulatory changes. For example, nursing homes may choose to hold onto their beds as a hedge against future unpredictability of CON Board. Examples include uncertainty regarding how long the bed market will operate, fear that the state will introduce a moratorium on new beds, or any other perceived issue that makes unused licensed beds potentially more valuable at present or in the future.

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Appendix Table. Total Number of LTC Bed Transactions and Average Sale Price per Bed in Ohio, 1991 – 2013.

Year	Total Transactions	Total #Beds in Transactions	Average Sale Price Per Bed
1991	1	16	$12,825
1992	3	113	$15,741
1993	5	204	$19,729
1994	21	685	$26,596
1995	3	65	$22,899
1996	5	240	$29,428
1997	10	316	$23,385
1998	13	472	$22,815
1999	13	306	$23,150
2000	5	165	$25,491
2001	22	719	$17,070
2002	26	758	$21,849
2003	38	914	$14,851
2004	37	819	$19,751
2005	44	1,285	$19,018
2006	32	950	$22,078
2007	25	584	$20,433
2008	33	1,172	$19,571
2009	40	729	$18,476
2010	86	1,867	$9,700
2011	11	233	$5,703
2012	35	986	$12,861
2013	11	268	$10,067