A REVIEW OF REGULATORY BARRIERS TO EMPLOYER ABILITY TO RECRUIT AND RETAIN EMPLOYEES

U.S. DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT

PD&R

A Review of Regulatory Barriers to Employer Ability to Recruit and Retain Employees

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Overview

While the impacts of residential development regulations and of economic growth on housing markets have been studied extensively, the impact of housing supply on labor markets and local economic growth (other than the direct effect of construction-related jobs) has not. Moreover, only one paper traces the influence of development regulations on housing outcomes through to labor outcomes at the metropolitan level (Saks 2005). In light of this fact, the U.S. Department of Housing and Urban Development (HUD) commissioned a review of the literature on the influences of residential development regulation on housing markets, and through them, on businesses, labor markets, and regional economic competitiveness.

Previously, HUD commissioned detailed reviews of the literature on development regulation influences on housing market outcomes (see for example Schill, 2004, and Quigley and Rosenthal, 2005). Those reviews did a thorough and comprehensive job of critically evaluating this literature and drawing findings from it. Rather than repeat this exercise, this paper is intended to provide a conceptual overview of the impact of development regulations on housing markets and how these impacts may influence labor markets, business location decisions, the economic competitiveness of metropolitan areas, the industrial composition of metropolitan areas, and labor productivity. Due to the lack of studies that attempt to model the impact of development regulations on employment outcomes in response to labor demand shocks, this paper reviews a large body of related literature on employment location dynamics, such as agglomeration effects and labor pooling, and the factors that influence labor migration. Some of this literature at least tangentially relates to the impact of higher housing costs and other regional quality of life factors on labor migration. Perhaps most importantly, this paper provides a conceptual framework for thinking about how development regulations intended to govern residential construction might have secondary impacts on labor supply and demand. It also highlights the data constraints that make it so difficult to study the impacts of residential development regulations directly on housing markets—let alone on overall economic activity—as well as the research questions most urgently in need of attention.

Regulations that govern residential construction result in housing market outcomes that could have labor market consequences. Specifically, development regulations constrain the supply response to demand by 1) imposing costs and restrictions on construction and 2)

constraining the type of housing that can be built and where it can be built. The former adds to the housing costs, lifts prices, and limits the capacity to supply housing over the long run. The restrictions on supply in the immediate area may result in a sprawling pattern of development and what has been characterized as a spatial mismatch between jobs and housing.

Affordable housing built at high densities is not permitted or is severely constrained relative to market demand in many jurisdictions. Many places that allow industrial and commercial development to strengthen fiscal capacity do not allow for construction of housing that is affordable to the workers employed in these economic activities or to essential municipal service workers such as police, fire fighters, administrators, and teachers. The distance between job locations and housing thus increases. This separation of jobs and housing induces longer commutes, as does the rent gradient that usually makes housing on the periphery of metropolitan areas less expensive than housing near employment nodes.

Of course, this stylized view of the influence of development regulations on housing market outcomes oversimplifies a complex subject, does not pertain in all places, and ignores a host of legitimate methodological issues that have been raised with much of the literature from which this stylized picture is drawn. Still, it is widely accepted that development regulations often have just these sorts of outcomes. More in dispute is the magnitude of the effects and the transmission mechanisms from regulations to market outcomes. The question of moment for this investigation is how these development regulation-driven housing market outcomes could influence labor markets, business location decisions, regional economic competitiveness, and the industrial composition of employment at the metropolitan level.

By constraining the supply response to housing demand, development regulations drive up long-run housing costs which should in turn place pressure on local employers to increase wages to attract and retain workers. It should also dampen employment growth in response to a positive labor demand shock because housing supply cannot keep pace with demand and workers don't come to fill jobs. This is precisely what Saks tested for and found in the one study that traces the impact of development regulations, through housing markets, on labor markets using econometric models (Saks 2004).

At a more micro level, the impact of higher housing costs and longer commutes on labor markets depends importantly on the type of labor. Employers and workers engaged in the production of goods or services for export to other regions face competitive pressure from producers located elsewhere that can recruit workers of comparable quality but lower cost because housing costs are less or commute times shorter. These firms are often called "basic industries" or "export-producing industries" even if some of their goods and services are consumed locally. Employers and workers in firms that serve strictly local demand do not face competitive pressures from firms in other locations in the conventional sense. Retail stores, for example, mostly compete directly with firms exposed to the same or similar housing market costs and labor market conditions (though they may face competition from non-store retailers such as web-based providers).

Local greengrocers, gas stations, beauty salons, drycleaners and the like as well as local public services constitute the far extreme of firms that serve a local market. They too may face difficulties recruiting or retaining talent as a result of long commutes and high housing costs. But all their competitors must struggle with these same problems. Despite difficulties, these firms will continue to provide their products and services as long as customers are willing and able to cover the costs of producing these goods and services and supply a competitive risk-adjusted return on their capital. Basic industries, on the other hand, can only remain competitive if the advantages of remaining or starting up in a high-cost area (or one with long commutes and congestion) outweigh any disadvantages.

In general, higher housing costs can increase the compensation it takes to attract and retain workers. The higher wages that employers must pay will not be seen by workers as higher real wages unless the wages more than offset the higher cost of living. Unless these higher costs for employers are justified by agglomeration effects (positive effects of businesses locating together for reasons of productivity, lower costs to recruit labor because of a concentration of workers with similar skills, reduced input and delivery costs, greater information), basic industries may eventually exit. Over time, the only basic industries that remain should be those that enjoy higher revenues or cost reductions to offset the higher wage rates. The non-basic, local service employers will respond by charging higher prices, adding to the cost of living pressures directly from housing.

Despite these expected outcomes, we could find no studies that actually attempt to empirically investigate or rigorously identify econometric equations to examine the direct or

indirect impacts of development regulations on the composition of employment or the costs of other locally provided goods and services. There is a theoretical literature that touches on it but little empirical work. Instead, the focus has been on the impact of these regulations on wage and employment growth in places with tight regulations relative to those with looser regulations .

There is a relatively well-developed literature that explores the influences of various conditions on labor migration. While, of course, labor migration is strongly influenced by labor demand, labor is motivated to migrate from one metropolitan area or another for a host of reasons. Among them are housing costs, commute times, and other costs of living and quality of life factors. To the extent that high cost areas make it more difficult to attract and retain workers, positions may get filled by inferior personnel that reduce productivity.

Spatial patterns of residential development that result in longer commutes, as well as higher housing costs, can influence the productivity of labor and the nature of labor supply. Workers that take long commutes may have to leave for family or other commitments at designated times and have less flexibility to work late, also reducing productivity. There is widespread anecdotal evidence of these effects, but no comprehensive studies.

People are willing to endure longer commutes and higher housing costs in certain metropolitan areas with tighter development regulations because they value the amenities and employment opportunities these places may offer. Indeed, some of the most costly markets with the most elaborate and expensive development regulations are considered highly desirable places to live and work, such as San Francisco, Hawaii, Boston, New York and Los Angeles. Like employers, employees may value agglomeration of similar firms because it increases their employment opportunities. But even in highly desirable areas, restrictions on housing supply may take an economic toll.

Unfortunately, the scholarly literature is largely silent on many of these issues. As noted, the influence of development regulations on the composition of employment has not been studied. The influence of housing costs on business location decisions has also not been well studied, nor the influence of these on labor productivity. The impact of higher housing costs or longer commutes on recruiting costs, employee turnover, or labor productivity also have not been studied much. Without such studies, the influence of development

regulations on labor markets, business decisions, and regional economic competitiveness remains very uncertain.

Moreover, despite greater attention to the direct impact of regulations on housing supply and cost, measures of development regulations and their administration remain underdeveloped and difficult to develop. Furthermore, the fact that these development regulations and their administration vary dramatically across jurisdictions within metropolitan areas is largely glossed over in most empirical studies. It is important to understand how these intra-metropolitan differences in regulatory intensity influence development patterns and traffic as well as how the aggregated effects of these regulations affect labor market conditions in one metropolitan area compared with another.

In the absence of fundamental understanding of many of these questions, it is difficult to judge what public policies might improve regional economic competitiveness or for business to recognize the effects of development regulations on their costs. In short, this investigation into the impact of development regulation on labor markets and businesses raises far more important questions than the existing literature permits it to answer. You will find these research questions in each of the core subject chapters. However, the final chapter describes four major research directions that should be pursued to further the understanding of the linkages between housing and employment and enable improved policy decisions. These broad initiatives are developed from multiple research needs and are not listed in a priority order.

1) Update and develop better measures for land use regulations and create a national database.

Measurements of regulatory restrictiveness vary greatly, and are often unreliable or out of date. Updated and improved measurements of regulatory restrictiveness are vital to the establishment of a comprehensive understanding of regulatory restrictiveness.

In addition to updated and improved measurements of regulatory restrictiveness, the authors suggest creating a comprehensive database containing up to date information on local regulations across the nation. Ideally, this effort would be accompanied by a national survey to collect a consistent set of specific elements on a regular basis.

2) Quantify how the diversity of regulations within a metro area affects the performance of entire metro area in order to: (a) gain finer resolution of impact by industry, sub-metro geography, and type of development structures; and, (b) determine if it is the quantity or the distribution of workforce housing that matters with respect to house prices, labor outcomes, and business growth, stability, and/or composition.

Within a metropolitan area, varying levels of restrictiveness may create an inaccurate overall impression of the restrictiveness of the entire metro area. For example, the efforts of a few low-restriction jurisdictions to encourage development may make a highly-restrictive metro area appear to be less restrictive than it actually is overall. Determining the effects of diverse regulatory restrictiveness within a metro area will provide a more accurate picture of what is happening on the local level. This study should also include an analysis of how regulations affect industry mixes and entry and exit of industries within the metro area. Metropolitan area empirical data is needed in order to understand the localized effects of regulatory restrictiveness on industry.

When studying the impacts of diversity of regulatory restrictiveness within a metro area, the authors suggest examining the effects on housing and labor market behavior within cross sectional studies.

The other two recommended research initiatives combine identified or suggested research projects primarily from chapters two through six into multi-faceted research initiatives. In doing so, the reader should be aware that each of these chapters identifies additional research ideas and needs that are missed in this summation.

3) Determine how housing costs and congestion affect industries and firms, including the following:
   - the rate of overall economic growth;
   - changes in industry composition;
   - differentiation by occupation, level of education, and income;
   - identification of industry winners and losers as a result of rising house prices; and,
   - identification of industry winners and losers as a result of congestion (commuting cost, delay, or uncertainty).

Industries that rely heavily on mid-skill workers and have to locate downtown or in dense employment centers may be most vulnerable to high housing costs and congestion effects. Firms locating downtown may have the benefit of better public transportation service, but much more expensive housing and parking. The goal of this research effort would be to quantify the degree to which industries vary in their sensitivity to housing costs and congestion effects.

4) Develop qualitative detail on how rising house prices affect employers through market research to address the following:
   - recruitment strategies, e.g., longer search, wider search, subsidize transportation/housing, training;
   - productivity measures, e.g., lateness, absenteeism, telecommuting, job shopping on the job; and,
   - retention / turnover , e.g., shorter tenure, higher wage and promotion.

To better appreciate the connection between house prices and labor supply, a deeper understanding of how employers respond is needed. Although this research project included case studies of selected localities, more data needs to be collected through interviews and other means to be able to fill in additional information on employer's behavior in a variety of economic circumstances.

Further information on each of these suggested research directions can be found within the body of the document and additional detail is provided in Chapter Seven: Recommended Research Directions and additional research questions are contained within each chapter.

Introduction

The purpose of the Workforce Housing Project is to develop a research agenda that shows the impact of regulatory barriers on employers' ability to recruit and retain employees. This paper contributes to that effort by reviewing the literature and offering recommendations for additional data collection and research. Presentation of this literature review to an advisory panel of experts provides them with the opportunity to provide their own feedback. The authors of this literature review are certainly aware that it is not comprehensive. However, the review constitutes a starting point for identifying the most important gaps in the existing research and the most promising new research directions.

The root problem is a shortage of workforce housing that is affordable given existing wages for a substantial range of working households. Beyond affordability, the issue of workforce housing encompasses the jobs-housing mismatch and the role that land use regulation plays. If businesses have difficulty recruiting workers because housing is so expensive or distant, the businesses cannot grow or effectively compete. Zoning is designed to preserve residential areas for adequate housing at different cost levels. However, moderate cost housing has often been squeezed out of locations near employment centers by more profitable and higher tax generating commercial uses. Workers face the tradeoff of less expensive housing with a long commute or a shorter commute from expensive and crowded housing. Employers must increase wages either to compensate workers for the long commute or more expensive housing. At some point, the lack of workers or the high cost of workers is enough to hurt the profitability of businesses, which may be forced to relocate where labor is cheaper.

High housing cost burdens for workers can reflect strong labor demand as much as limited housing supply. It is analogous to the commuter congestion problem. When a local economy is booming, the roads are usually congested with commuter traffic as demand for access outstrips supply. Although high housing prices and congestion delays often accompany growth, they may ultimately constrain continued growth. Some firms can sustain higher wages as long as the increased employment density results in better matching of employees to jobs and higher productivity, but productivity may actually suffer for other activities, and high wages may drive away firms that do not enjoy offsetting revenue gains or cost savings. Moreover, technology keeps advancing, though not

necessarily smoothly, and may eliminate the factors that have anchored firms to high-cost locations. If cities adopt too many regulations that block growth and change, workers and firms will eventually move to places where they get a better deal. The issue of workforce housing is fundamentally about urban efficiency in creating a productive environment that can compete for growth. Businesses should care about workforce housing because their growth prospects are tied to the availability of labor, which in turn, is limited by the availability of moderately priced housing and adequate transportation networks.

The following literature review is organized into seven chapters. The first chapter on Housing Market Effects establishes the links between land use regulations, an inelastic housing market, labor supply, spatial mismatch, and the commuting congestion that results when workers bridge the long gap between work and home. The second chapter highlights the business perspective in which businesses attempt to fill their vacancies and hang onto their existing workers either by moving to labor pools or enticing the labor to migrate to the business. Literature on the differing demands by industry and the choice of business location are followed by papers on agglomeration effects, business dynamics, migration, and new data measures of labor activity and regulatory stringency. Chapter three looks at metropolitan labor supply issues resulting from a constrained housing supply. In the fourth chapter, labor productivity is subdivided into sections on wage models, turnover, training and returns to skill. A fifth chapter on spatial dimensions considers the topics of spatial mismatch, jobs search, migration, commuting costs and the jobs-housing balance. The sixth chapter deals with issues of commuting and transportation. Our recommendations for the workforce housing research agenda are summarized in the final chapter. Those recommendations are broad and should be read as more general directions rather than specific research projects. Many other research questions and suggested research topics are contained throughout the document.

Chapter One: Housing Market Effects

The recent boom in housing prices and widespread decay of affordability across many of the nation's largest metropolitan areas have increased concern over the effects of housing affordability on the future economic growth and well-being of these areas. Of primary concern is that local land use regulations, intended to shape the physical growth of an area, may in fact be hindering the area's potential for economic growth by contributing to high housing costs that repel would-be workers and employers. Indeed, the effect of land use regulations on house prices and affordability has been well studied. A recent literature review by Quigley and Rosenthal (2005) lists no less than 40 such empirical studies in the last four decades, the majority of which indicate that factors which restrict development are associated with inelastic housing supply responses to increasing demand and high housing prices. Fewer studies have looked at the potential effect of housing supply and housing cost on metropolitan economic growth. Even fewer of these studies, only a single one in fact, has traced through the effect on metropolitan employment and wage levels from regulations and the regulation-induced inability to build housing quickly enough during periods of economic growth.

We review the literature on the effects of development regulations on housing market fundamentals, the limited empirical findings on the effects of housing market fundamentals on labor market fundamentals (jobs and wages), and the even more limited empirical findings on the effects of development regulations on labor market fundamentals at the metropolitan level. To detect an influence of development regulation on metropolitan area markets, a variety of different measures of regulation and regulatory restrictiveness have been used. Given their importance and variety, we begin with a review of regulations themselves. The second section reviews the large literature on the relationship between development regulations and housing markets. We divide this literature into two types of studies, those that test for a direct relationship between regulations and high house prices, and those that model the effects of regulations on lowering supply elasticities, which are then related to high house prices in the long term. The third section reviews the more limited empirical findings on the effects of housing supply on labor market fundamentals (jobs and wages) at the metropolitan level. We conclude with a discussion of the most significant gaps in the literature with respect to the possible impacts of development regulations—via higher housing costs and constrained housing supply responses—on

metropolitan economic activity. Importantly, the literature is largely silent on whether development regulations influence the industrial mix of a metropolitan area over time.

Defining, Measuring and Comparing Regulations

There is no single, commonly accepted definition of regulatory restrictiveness. The term can be loosely defined as the net limiting effect that local land use regulations have on development in a given area. Land use regulations are defined as the set of controls that a jurisdiction places over growth and development in that area. These controls may include zoning regulations, environmental laws, historic preservation mandates, development fees, procedural requirements for developers, or any of a number of government-induced elements that affect land use and development. Though regulation is often seen as a term that is interchangeable with restriction, regulations are not always negative, and as Pendall et al. (2006) describes, regulations may be enacted as part of an area's overall growth management framework, which may encompass both restrictions and incentives. Under this broader framework, regulatory restrictiveness would be the net result of the balance between land use restrictions and countervailing efforts to promote development such as government incentives and affordable housing programs.

Economists, however, describe regulations more negatively as influences outside of what would be imposed by an entirely free market which work to raise development costs or reduce the quantity of development from levels that would otherwise be possible (Mayer and Somerville, 2000). As they stated succinctly, regulations "work locally to restrict development by adding explicit costs, uncertainty, or delay to the development process."

Although federal and state governments impose regulations that influence the cost and nature of residential development through environmental and other dictates, most regulatory authority is delegated to and exercised by the city, town, or county governments. The diffusion of regulatory power without any standardized set of controls across areas, has made it difficult for economists and planners to define and identify similar degrees of regulatory restrictiveness across metropolitan areas. This, of course, seriously hampers an attempt to use cross-sectional analysis to determine the effect that such regulations may have on the supply and cost of housing. Even if local governments across the country had the same set of regulatory tools in their toolboxes, application of these tools varies across the country. As Pendall (2006) finds, regions have different preferences for different types

of regulations, which limits the ability to compare restrictiveness across regions that use different methods to achieve similar goals. Furthermore, thousands of cities, towns, and counties regulating land use around the country have diverse attitudes toward development, interpretations of model codes, and operating procedures that may not be entirely reflected within the text of the local regulations themselves. In other words, two locations with the same set of regulations may have entirely different administration of these regulations that result in different actual limitations on development. Many development regulations grant considerable discretion to local planning boards and zoning boards of appeal in how they are ultimately implemented. Even if local governments across the country had the same set of regulatory tools in their toolboxes, therefore, it would still be difficult to draw conclusions from cross-sectional analysis.

With these difficulties in mind, several papers have made attempts at categorization of land use regulations in an effort to develop serviceable measures of local or metropolitan area regulatory restrictiveness for econometric modeling. Most studies focus narrowly on the regulatory restrictions themselves, or what Schill (2004) calls the "barriers to development." One of the most concise and explanatory categorizations of these barriers is offered by Quigley and Rosenthal (2005) who refer to the five types of regulatory restrictions proposed by Deakin (1989) as follows:

1) Limits and geographic preference on the quantity or density of development allowed (i.e. basic zoning)
2) Design and performance standards for lots and buildings (i.e. design guidelines)
3) Costs shifting from the locality to the developer (i.e. utility fees)
4) Reduction of the amount of land available for development (i.e. environmental regulations)
5) Direct and indirect controls on growth, applied against buildings and population (i.e. growth boundaries)

Pendall, et al. use a more simple categorization of land use regulation to differentiate between simple zoning versus more involved limitations on the pace, location, or extent of development.

Branching out from the taxonomical study of regulatory restrictions, studies of the effect of regulations on house prices use either single measure or composite measure. Single

measure studies look at a single regulation thought to be important in order to determine its effect on house prices or other economic measures. Findings from these studies are varied (Fischel 1989). In his 2004 study, Schill notes that "for some regulations, such as building codes and environmental regulations, the literature barely exists. For others, such as land use regulations and impact fees, many studies exist, but the results are often contradictory and difficult to interpret." Difficulty in measuring the effects of a single regulation stems partly from the fact that regulations rarely appear alone, and are more commonly put in place where other types of regulation already exist (Pollakowski & Wachter 1990, Shuetz 2005). For instance, Dain & Shuetz (2005) find that of 187 communities in Eastern Massachusetts, 97 percent have subdivision by-laws, 70 percent have wetlands by-laws, and 60 percent have local septic regulations. With the tendency for regulations to appear in groups, looking at specific land use regulations as if they are independent of each other would lead to underestimates of the impact of growth controls on local economics. (Pollakowski & Wachter 1990). Regulatory influence on local economics must also include effects of statewide regulations, and following Pollakowski and Wachter (1990) it is apparent that regulatory influences on house prices also include extra-territorial spillover effects.

The need expressed by Pollakowski and Wachter to view specific land use controls "in the context of overall land use policy" suggests that the use of a composite-measure type of study may be more appropriate. (Peterson 1974, White 1988, Linneman 1990, Malpezzi 1996, Saks 2005). Composite measures are built as indexes of regulatory activity. Malpezzi (1996) offers a good example of how measures from surveys are built into composite regulatory indexes. His index is as follows: (1) the change in approval time (zoning and subdivision) for single family projects between 1983 and 1988 (1=shortened considerably, 2=shortened somewhat, 3=no change, 4=increased somewhat, 5=increased considerably); (2) estimated number of months between application for rezoning and issuance of permit for a residential subdivision less than 50 units (1=less than 3 months, 2=3-6 mos., 3=7-12 mos., 4=13-24 mos., 5=GT 24 mos.); (3) Similar to (2) but time for single family subdivision greater than 50 units; (4) how does the acreage of land zoned for single family compare to demand? (1=far more than demanded, 2=more than demanded, 3=about right, 4=less than demanded, 5=far less); (5) how does the acreage of land zoned for multifamily compare to demand? (1=far more than demanded, 2=more than demanded, 3=about right, 4=less than demanded, 5=far less); (6) percent of zoning changes approved (1=90-100%, 2=60-89%, 3=30-59%, 4=10-29%, 5=0-10%); (7) a scale for adequate

infrastructure (roads and sewers), (1=much more than needed, 2=slightly more, 3=about right, 4=less than needed, 5=far less than needed).

Although indexes like this provide a framework for gauging the relative regulatory restrictiveness of different places, models that use them to derive definitive conclusions about any specific effect of regulations themselves may still run into some difficulty. The first such difficulty is that a highly regulated development environment may also proxy an area's overall anti-development attitude, which may induce impacts that have little to do with the specific regulations incorporated in the index, but cannot be separated from the effect of the regulations themselves within a model. Second, composite indexes have limited ability to control for variations in regulations within the cities and towns that comprise a metropolitan area. This is an important factor when such indexes are used to compare restrictiveness across metropolitan areas. Third, building an index of regulatory restrictiveness requires a certain number of subjective determinations in terms of the regulations included in the index and the relative weight given to each measurement as a percentage of the total index value. This is especially noteworthy for cross-metropolitan studies given that recent findings suggest different regions prefer different types of regulations (Pendall 2006).

Whether considered separately or part of an index, data on regulations are difficult to collect. Data may be gathered through first hand research of documents from individual towns detailing the regulations themselves. The time intensity of such an effort usually limits these surveys to a small number of cities or towns within a metropolitan area. For instance, Dain and Shuetz's (2005)'s ambitious compilation of regulations in 187 communities in Eastern Massachusetts was used by Glaeser, Schuetz, and Ward (2006) to study whether regulations, not land supply, have caused low levels of new construction and high house prices in Greater Boston. Similarly, Greene (1999) looks at 37 suburbs of Milwaukee to find the effects of six specific land use restrictions on house prices, and Pollakowski (1990) looks at time series data from 17 planning area groups in Montgomery County, MD, to study the influence of spillover effects of restrictions in neighboring jurisdictions on local house price changes.

To extend the geographical range, studies may utilize second-hand surveys of local planning or regulatory authorities. Pendall et al. (2006), use this method to gather regulatory information from nearly 1500 cities, towns, and counties in the top 50 metropolitan areas. Other studies such as Saks (2004) and Malpezzi (1996) have used a

combination of cross metropolitan surveys. Unfortunately, aside from Pendall and the recently updated Wharton study (Gyourko, Saiz, and Summers, 2006), the most recent of these surveys were published over ten years ago and are based on data collected several years before that. Some of the more widely used cross-metropolitan studies are:

1) The Wharton Land Use Control Survey 1990. This has been perhaps the most widely used survey in recent studies of regulatory restrictiveness. This is a survey of local officials on the various aspects of their zoning and other policies that may limit development. Among the most widely used indicators from this survey are time-to-approval measures, such as the average length of time for subdivision permits to be approved or the change in zoning approval time from 1983-88.
2) Srinivasan and the Regional Council of Governments (1985) survey local officials to estimate the amount of otherwise developable land rendered un-buildable by regulations. While appealing, the results are ultimately subjective.
3) The American Institute of Planning in1976 published its Survey of State Land Use Planning Activity, which indicates the presence of various land use policies for each of the 50 states.

In sum, there are six principal problems in measuring development regulations for the purposes of evaluating their individual or collective impact on housing markets. First, the complexity of regulations and variations in administration among thousands of local regulatory agencies means there is no shared standard among jurisdictions or metropolitan areas. Second, the diffusion of regulatory authority and diversity of regulations also make data collection difficult, and lead most studies to rely on a small number of dated surveys, each with its own inherent flaws. Third, there is an inherent difficulty disentangling effects of specific regulations and constellations of regulations. Fourth, once a bundle of relevant measures of regulatory restrictiveness are chosen for use within a model, there remains an inability to conclude whether any measured effects are caused by the specific regulations themselves or a broader opposition to development they may represent. Fifth, by looking to model whether areas with similar regulations have similar changes in house prices, models fail to capture differences in enforcement of regulations across jurisdictions or admit the possibility that jurisdictions with similar restrictions may apply them differently. And lastly, composite models of regulatory restrictiveness rarely focus on intra-metro variations in restrictiveness.

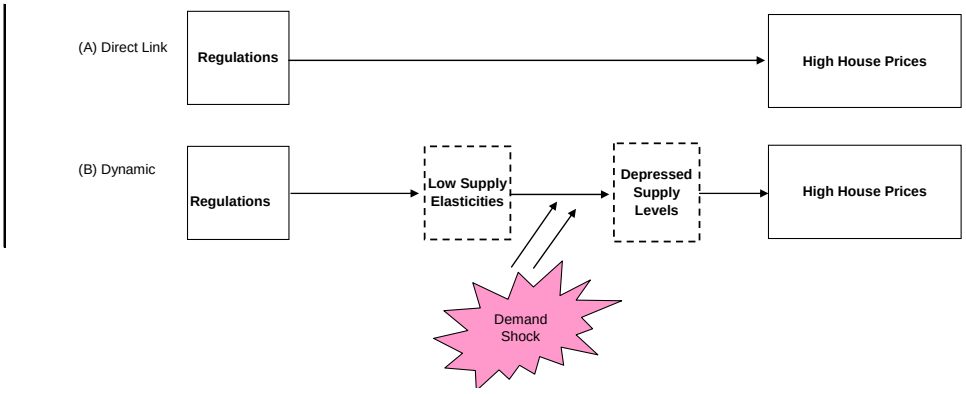
Regulations and House Prices

The theoretical link between regulations and house prices and construction levels is well-established, though at times complicated. Nearly all empirical studies find that regulatory restrictions add to development costs and reduce construction levels either directly or indirectly through one or more of the following actions:

restricting land available for development;
reducing unit densities of development;
adding delay and risk to the development process;
adding directly to costs.

Two general types of study test either for a direct relationship between regulations and high house prices, or for a direct relationship between regulations and lower supply elasticity, which translates into high house prices over time. Studies that model regulatory effects on house prices directly tend to focus on factors that limit supply levels or impose undue costs on development. Elasticity models, while also focusing on factors that impose costs, add emphasis to factors that delay the development process and therefore impact supply responses to shocks in demand. Both types of study focus on long-term impacts and may include both cross-sectional or cross-year survey data. Elasticity models, however, incorporate short-term supply reactions to demand and therefore take the secular increase in high-housing costs as the cumulative impact of depressed supply elasticities in a metropolitan area subject to constant demand shocks. Elasticity is a term used to describe the responsiveness of supply to changes in demand.

Figure 1: Modeling Regulatory Effects on Housing: Direct vs. Elasticity-based



Direct Effects on House Prices and Construction Levels

Most studies on regulations and the housing market look to establish evidence of a direct relationship between restrictive regulations and house prices and/or construction levels. In general, higher housing prices and lower construction levels are attributed to restrictions on land available and unit densities, delays in the development process, and development fees in the following manner:

Restrictions on land available and unit densities. Steady-state models of regulatory effects on house prices share greatest agreement in showing how restricting unit densities or land available for development increase long-term house price and construction levels by constraining total supply to levels below that which would otherwise satisfy demand in that location. Studies incorporating these types of regulations model the steady-state house price and construction levels to show long-term impacts on metropolitan area housing market. Representative studies include Segal and Srinivasan (1985), who used their survey of local officials to find that house price inflation had a nonlinear relationship with percentages of land removed from development by regulation, resulting in significantly greater house price and appreciation levels for the most restrictive cities when compared to those unrestricted cities. Glaeser (2006) uses a collection of regulatory and house price data from Eastern Massachusetts municipalities to find that high house prices in Boston are not based on a shortage of developable land, but on the rights associated to the land that is developable. Density based regulations are also linked to high house prices within Glaeser, Schuetz and Ward (2006) where median house prices in municipalities near Boston correlate to minimum lot size allowed in their zoning by-laws.

Models on house prices are also commonly paired with similar models associating regulations to reductions in steady-state construction levels. For instance, Glaeser et al. (2006) also uses models to show that regulatory environments reduce steady-state construction levels in Manhattan and Greater Boston to far below what would have been constructed if they had been less regulated areas. Similarly, Katz and Rosen (1987) study house prices in several San Francisco municipalities in 1979 and find house prices in areas with growth control plans or growth moratoria, which simply do not allow development in certain areas, were 17-38 percent higher than in those without.

Delays in the Development Process: Several studies look at the effect of delay variables on steady state price levels. The basic measure of delay within most recent studies is taken from the Wharton Land Use Control Survey, which asks for the average time between applications for rezoning and issuance of building permits. This variable is indexed in Gyourko and Glaeser (2003), as a measure for overall regulatory restrictiveness, and is found to have significant positive relationship with house prices. Delay variables are also used as part of a more comprehensive regulatory restrictiveness index constructed by Malpezzi (1996), which is also used in Malpezzi Chun and Green (1998), which as part of an index is found to correlate with higher prices, but singular effects of delay itself are not identified. Malpezzi (2002) uses the same index and finds regulation effects on prices not only significant, but substantial, and that a one unit increase in the regulation index (which ranges from 15-30) amounts to an 8.5 percent increase in house prices. Mayer and Somerville (2000) find that delays in the approval process have a significant negative effect on the level of construction in a metropolitan area, lowering the "steady-state" level of housing starts by up to 45 percent in a MSA, with greatest impact given to those regulations that lengthen development times.

Development Fees: The impact of development fees has a complex relationship to house prices. As stated by Evans (2003), theory states that absent close substitute markets, builders will respond to high impact fees by passing the cost on to the consumer through higher house prices, or possibly ignoring lower-income households and focusing on more expensive housing where the impact fee can be more easily passed on (Huffman et al. 1988). Empirical studies largely show that development fees increase house prices, but differ on who bears the burden of the fee and how fees translate to added costs to consumers in the form of higher house prices. Two studies identified in the Evans (2003) review separate effects of development fees using time series data on areas before and after impact fees are introduced. The first study is Delaney and Smith (1989a), who build a constant-quality index to find that impact fees in one community had a positive impact on new home prices relative to two neighboring communities, and the second is Singell and Lillydahl (1990), who find an increase in prices and the pace of house price appreciation in Loveland, Colorado, after impact fees are introduced. A more recent study by Ihlanfeldt and Shaughnessy (2002) finds that a $1.00 increase in development fees increases the price of both new and existing housing by about $1.60, an amount attributed to the tax savings expected by homeowners in a fee-based system. The study also finds that land prices are

reduced by the amount of the development fee, suggesting burdens of the fee are born primarily by owners of undeveloped land.

Models on the relationship between development levels and impact fees have resulted in conflicting findings. Looking across metropolitan areas at the effect of impact fees on development, however, Mayer and Somerville (2000) conclude that the presence of development fees does not show a significant effect on construction levels given the existence of long approval processes and other growth management techniques in an area. In contrast, Skidmore and Peddle (1998), who study a sample of all municipalities in DuPage County, Illinois, from 1977 through 1992 find that impact fees reduce residential development by over 25 percent.

Regulations, Supply Elasticities, and House Prices

In contrast to studies looking to establish evidence of a general, long-term relationship between regulations and other housing market factors, a second type of study tests for a more direct relationship between regulations and the elasticity of the housing supply. Supply elasticity models explore the relationship between regulatory restrictiveness and construction levels given changes in demand fundamentals, such as would occur in periods of rapid economic expansion. Within elasticity models, there is a focus on regulations that impose additional costs or delay to the development process. This follows the theory that new regulations that add direct costs to the development process initially depress development because in the short run, these costs are typically borne by the developer (Huffman et al. 1988). Regulations that add delay or risk to the development process similarly reduce production responses by increasing the reaction time builders need to respond to any increases in demand. These factors are then indirectly associated as supply side determinants of house price dynamics to show positive shocks in demand are forced to translate into positive shocks in house price given an inelastic supply. Theoretically, while low supply elasticity translates into higher house prices in the short-term, it may also affect prices in the long term as a metropolitan area experiences multiple demand shocks to which its supply levels never fully respond. Models confirm expectations that if regulations lower steady state construction levels in a metropolitan area, they will also inhibit an area's ability to respond quickly and completely to shocks in demand fundamentals with additional housing.

Example studies modeling the effect of regulations on housing supply elasticities include Quigley & Rosenthal (2004) who model this supply elasticity for cities in California, differentiating between those minimally regulated, with less than two growth control regulations, and the highly regulated with two or more. Given exogenous predictors of increased housing demand, responsiveness of the housing stock via new construction is weaker in more regulated cities relative to less regulated cities. Mayer & Somerville (2000) also model the elasticity of housing supply and find similarly that regulation lowers elasticity of housing supply by up to 20 percent in a highly regulated MSA, and appropriately find that elasticities are especially low for metros that have regulations lengthening development times. Glaeser, Gyourko and Saks (2006) also explain that limited supply response to demand for housing in Manhattan "primarily is the consequence of an increasingly restrictive regulatory environment."

House Prices and Labor Markets

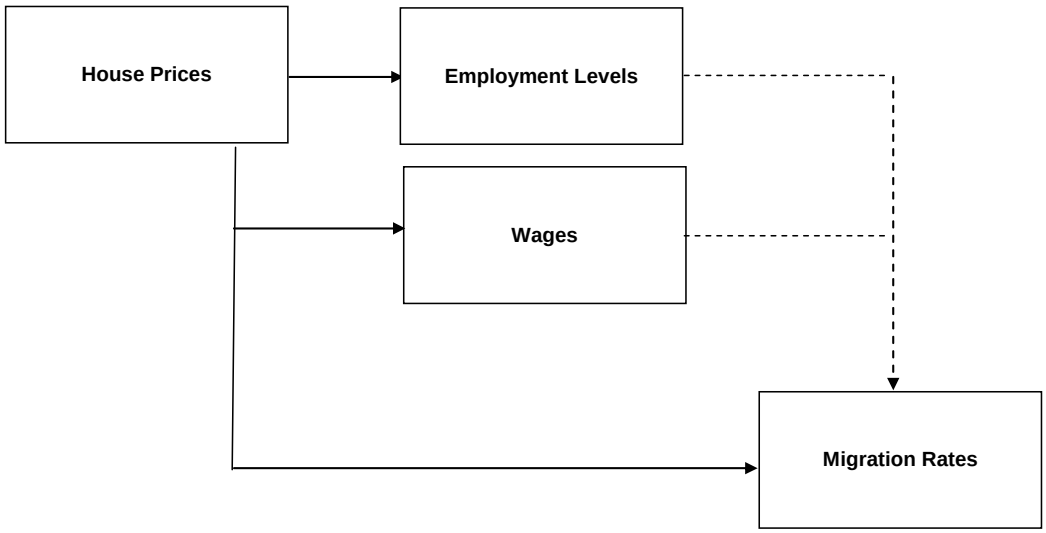
Though not modeled in the Quigley and Rosenthal nor the Somerville papers, the fact that restrictive regulations have a significant reducing effect on metropolitan area elasticities of housing supply suggests that regulations may also have a significant negative effect on job growth in highly regulated areas during economic boom times. The same holds true for population growth. In other words, it follows from these studies that slowed growth in the housing stock means actual employment and population growth in response to growth in demand for employment and population is also depressed, and that both are associated with restrictive regulations. However, while many studies look at the effect that regulations have on house price measures, a much smaller subset of these studies link regulatory restrictiveness to a metropolitan area's ability to grow its economy.

The primary link between regulations and economic growth is through the area's ability to grow its housing stock, and therefore its population of workers, in response to increases in positive housing demand shocks created by expansion of employment in growing industries. Comparative studies have associated reduced levels of metropolitan-level immigration, population, and employment growth with high housing costs, but none have also included links to regulatory restrictiveness – a major contributor to the high housing costs.

The link between high housing costs and reduced immigration is established in several studies. Case (1991) finds the housing boom in Massachusetts 1984-1987 created a

significant increase in demand for labor, but also contributed to a slowdown in the growth of the labor force. Case gets his findings by isolating the effect of high home prices on labor force growth empirically and demonstrating that high home prices discourage labor force entry. Referenced in the Case study are results from Gabriel (1991), who concludes in his study that house price differentials between metropolitan areas offset incentives to migrate to regions with tight labor markets and deter migration from lower cost to higher cost regions.[1]

Figure 2: Models Linking House Prices and Labor Markets Generally Do Not Include Regulations



A related set of studies explores the relationship between metropolitan-level housing costs, employment levels, and wages. These studies find that, given similar predicted values of employment and wage changes due to shifting fundamentals, areas with high housing costs have lower job growth and higher wage increases in response to increases in demand. An

[1] See also Bluestone (2006) who looks for nationwide data to support the theory that high house prices are negatively impacting job growth and migration in Massachusetts, and using a steady state OLS model of house prices on employment and migration with data from 300 metropolitan areas, finds some evidence that housing costs play a role in employment growth and that after controlling for the strength of the labor market, there is an independent and statistically robust effect of housing costs on metropolitan migration patterns.

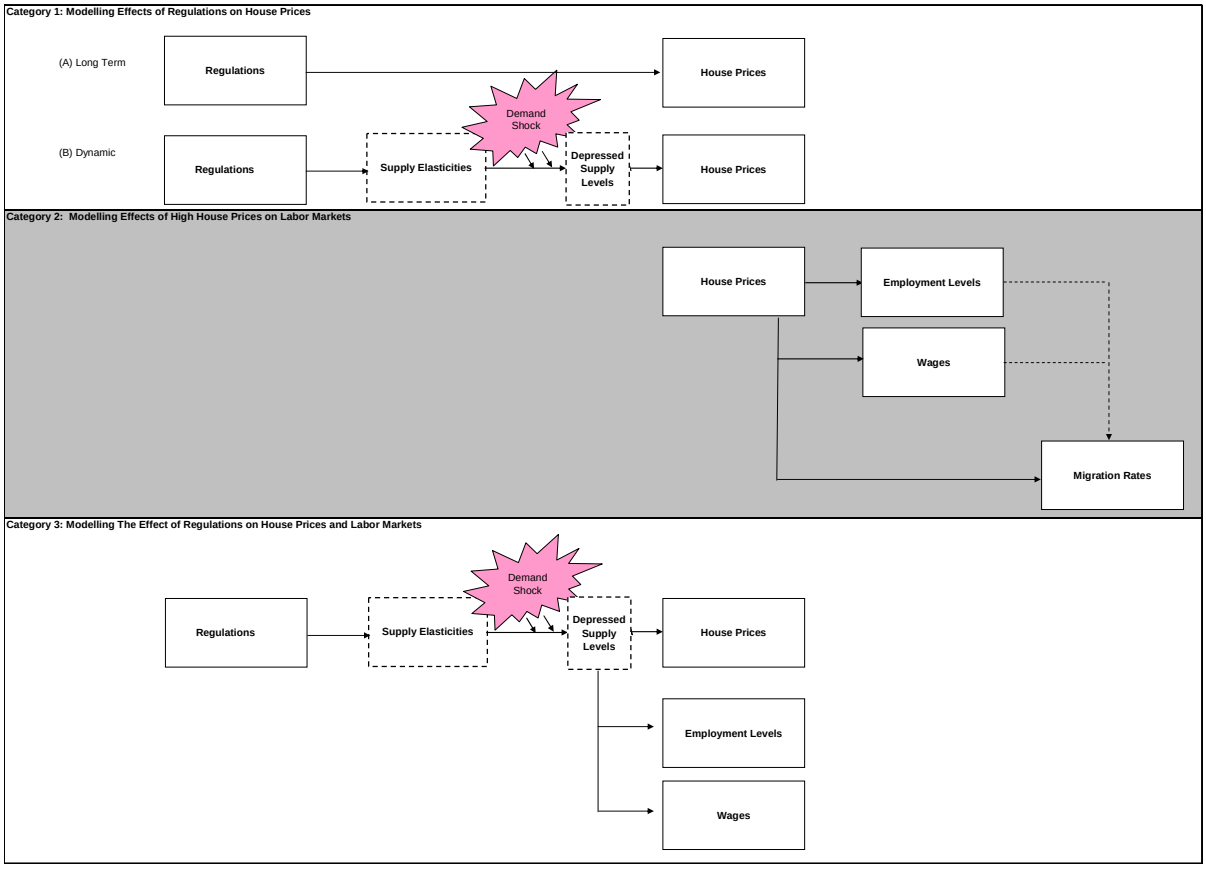
example study is Johnes (1999), who examined interactions between local housing and labor markets in the Hartford, Houston, Fort Lauderdale and Milwaukee areas using quarterly data for the 1980s. The study looks at dynamics, and specifies an error correction model with reduced-form equations explaining the average wage, the unemployment rate, the labor force and the average house price in an urban area[2] and finds some evidence that unemployment and labor force changes affect house prices and that house prices have a significant effect on the size of the labor force. Bover (1989) looks at the effect of high house prices on migration and wages in the Southeast UK. Bover's major contribution is in finding that areas with the lowest supply elasticities saw the lowest net migration levels, the highest wage levels, and the greatest increases in price to earnings ratios given nationwide increases in labor demand. Bover briefly mentions planning and zoning constraints as an example of an institutional distortion that would theoretically raise returns on owner occupied housing, but stops short of modeling relationships between these constraints and the regional trends in employment and wages.

Regulations and Labor Markets

Given the wealth of studies finding that regulatory restrictiveness constrains metro-area housing supplies and increases costs, and the additional body of literature on the relationship between high housing costs and reduced inter-metropolitan migration and flows of labor, reduced employment growth, and higher wages, it follows that there would be a relationship between regulatory restrictiveness and labor dynamics. This is mentioned briefly in Bover, but only a single study, Saks (2004), empirically connects the path from regulatory restrictiveness to labor markets. The following section details this study.

[2] (The reduced form house price equation is modeled with explanatory variables of local wage level, interest rates, and the stock of houses available in the previous period.)

Figure 3: Regulations and Labor Market Dynamics: Connecting the Link



Saks (2004) is the first study to empirically determine a relationship between regulations and labor supply through a series of modeled relationships. Ultimately, the study finds that the inability to respond to demand shocks with housing fast enough or completely enough, such as occurs in areas heavily constrained by regulations, leads to a suppression of labor demand, (i.e. fewer actual jobs resulting from labor demand shocks) in both the short and long term.

The study begins with a simple model relating variation in the elasticity of housing supply to local regulatory constraints through estimating parallel regressions of annual changes in the logarithm of housing prices and the housing stock on the labor demand shocks and an interaction with the index of housing supply regulation. Two key variables in this model are the regulatory restrictiveness index and the predicted labor demand. The restrictiveness measure is created for this study as a single, comprehensive, composite index of restrictiveness according to variables from six other indexes, including the Wharton survey. The second key variable is that of predicted change, or shock to labor demand, which

follows the methodology of Bartik (1991) and is based on state and national employment trends for the industries heavily represented in a metropolitan area.

The resultant model is as follows:

$$p_{it} = \theta\ h_{it} + \pi\ r_i h_{it} + x_i + d_t + \varepsilon_{it}$$

where *i* indexes metropolitan areas and *t* indexes time, *p* is the log of house prices (or housing stock in the parallel model), *h* is the annual change in housing demand (labor demand shocks), r represents regulatory restrictiveness, x and d represent location and time specific fixed effects, and ε represents the error term.

Results from the study find that, on average, a 1 percent increase in labor demand is associated with a 0.25 percent increase in the housing stock and a 0.8 percent increase in housing prices. The interactions show that where a 1 percent increase in demand would lead to a 0.35 percent increase in the housing stock in an area with an average amount of housing supply regulation, the effect of the same demand shock would be 17 percent smaller in an area with a 1 standard deviation higher value of the housing supply regulation index.

The second stage of this study focuses on the effect of housing on labor markets. The model used is based on the labor dynamics model of Blanchard and Katz (1992) with added variables to explicitly indicate housing market characteristics such as the regulatory index, the elasticity of housing supply, and fixed city-specific factors that may cause persistent differentials in house prices across metropolitan areas. The resultant three econometric models include the change in the logarithm of employment, the logarithm of wages, and the logarithm of housing prices each as a function of two of its own lags, two lags of the other endogenous variables, and the contemporaneous labor demand shocks with the following form:

$$Y_{it} = \begin{bmatrix} \Delta n_{it} \\ w_{it} \\ p_{it} \end{bmatrix} = B_1 Y_{it-1} + B_2 Y_{it-2} + B_1^r Y_{it-1} reg_i + B_2^r Y_{it-2} reg_i + C\hat{\varepsilon}_{it}^d + C^r \hat{\varepsilon}_{it}^d reg_i + D_i + D_t + V_{it}$$

To examine how labor and housing market dynamics vary with the elasticity of housing supply, variables for wages, employment levels, and house prices are interacted with the index of housing supply regulation. Interactions result in findings that in highly-regulated areas demand shocks increase employment, wages, and house prices to a greater extent than in less-regulated areas.

The model also shows regulations may have a lasting impact on wages as long as housing prices are also permanently higher. The long-run impact of a 1 percent demand shock in a highly constrained market results in only a 0.9 percent increase in employment, instead of the 1 percent increase found in less constrained areas. Additionally, measured over a twenty-year period, in New York, which was estimated to have the most inelastic housing supply, a 1 percent increase in labor demand leads to only a 0.65 percent increase in employment.

Lastly, the study models aggregate output indicators on regulatory restrictiveness and finds that constrained employment growth due to housing regulations has an aggregate effect on the economy lowering the gains from migration by about 18 percent in constrained areas relative to those with fewer constraints.

Though literature on the effects of regulations on labor markets is sparse, Saks (2004) covers much ground, especially in noting that findings refute assumptions made in models such as Blanchard and Katz (1992) that assume relative wages across local areas tend to converge over time. Following this work, regulatory restrictiveness can be shown to inflate house prices in long and short term, inflate wages to compete for labor in the face of higher costs of living, suppress demand (quantity of employment) given similar shocks to the economy, and increase sprawl (land consumption), longer commutes, and lower than optimal metro area productivity.

Regulations and Industrial Compositions

While Saks details the effect of regulatory restrictiveness on aggregate employment and wages, no known studies detail the effect of restrictiveness on industry composition.

There is established theory of how relative wage differentials affect industry dynamics and inter-metropolitan industry composition (Blanchard and Katz 1992). Several non-empirical

studies point to the implied relationship between high housing costs and industry composition of certain metropolitan areas. Cheshire (2004) refers to Flammang (1979, 1990) and states that rising incomes "imply rising costs and a continuing loss of lower value added activity," and lists "travel agencies, retail, real estate" and other services as disproportionately located in large cities as a sign of transaction economies (Stein 2002), but actual industry composition is not tested in relation to high-cost metros or regulatory restrictiveness. Other studies give statements that industries leave high-cost areas (Glaeser 2006), but limited evidence pointing to this relationship.

Malpezzi (2002) comes closest to the topic with an empirical study of the relationship between aspects of the "new economy," land use and development regulation, and housing prices. Malpezzi tests whether a single industry-sector, high-tech, is associated with regulations, given the assumption that high-tech industries are footloose and high-paying and therefore are attracted to either a) high-amenity areas that are "the foundation of local regulation" or b) traditional high-growth areas that have put regulations in place to stem this growth. Using the regulatory restrictiveness index developed in Malpezzi, Chun, and Green (1998), and the DeVol (1999) instrument for the area's high-tech quotient, Malpezzi fails to find any support for a relationship between high regulation and high-tech industries.

Summary and Research Extensions

What we know: much literature has linked restrictive development regulations to higher prices, and other studies have linked impaired supply responses to lower migration levels and employment gains during times of economic expansion, but few studies empirically connect housing regulations and labor markets, and only one study links restrictive development to lower employment gains and higher wages during expansions. Saks (2004) gives direct support that regulatory restrictiveness has significant long-term impacts on steady-state employment and wage levels that had previously been buried within metropolitan fixed effects of other models.

This review finds that there are several questions that remain at the macro level. The first is how regulatory restrictiveness affects metro area industry composition and change. While there is an established body of knowledge on how wage differentials affect inter-metropolitan industry compositions, and Saks (2004) has linked how regulatory restrictiveness contributes to these wage differentials, an elaboration of how regulations

affect industry mixes and entry and exit of industries within a metropolitan area have not been subject to rigorous empirical study.

The second question involves how the diversity of regulatory restrictiveness within metropolitan affects housing and labor market behavior within cross-sectional studies. Indexes on a metropolitan scale are forced to agglomerate effects of both restrictive and non-restrictive regulatory jurisdictions with diverse attitudes toward new development. This approach encompasses, for instance, how the existence of a few low-restriction areas eager to attract new development may impact the overall dynamics of an otherwise highly restrictive metropolitan area in terms of both housing supply, as suggested by Pollakowski and Wachter (1991) and labor force.

A third remaining question involves the age and reliability of available data on regulatory restrictiveness. As mentioned in Pendall (2006), the absence of a detailed national database with up-to-date information on local regulations inhibits cross-metropolitan study of the impacts of regulations. In order to obtain a greater degree of rigor and significance in regulatory studies, there remains a need to update and improve measurements of regulatory restrictiveness that are both recent and expansive; standardized or normalized across metro areas; and reflective of differences in strictness of enforcement across jurisdictions. Creation of such a database would require a substantial effort to compile and maintain. The alternatives would be a continuation of the numerous limited one-off surveys every few years, or the unlikely scenario of achieving greater standardization of the regulations themselves in terms of creation and implementation on the state and local level. Truly the relationship between regulations, housing, and labor markets is complex and much remains to be known.

Chapter Two: Business Perspective

High housing costs and limited housing availability logically have an adverse impact on businesses and jobs, but that impact is difficult to demonstrate, in part because there are such strong influences in the opposite direction. Rapid growth in output and employment in a local area tends to drive up housing prices and create supply shortages, so that there is generally a positive correlation between changes in employment and housing cost. Also, places where housing is limited and expensive also tend to have other characteristics, such as highly educated populations, that have been favorable for growth.

Saks (2005) has provided unprecedented evidence that job growth in areas with highly regulated housing markets would have been even greater without the housing constraints. The local area industry mix plays a central role in Saks' analysis, since the estimate of unconstrained "shocks" to local employment is calculated as the employment growth that would have occurred if each industry in the area matched growth for that industry elsewhere. But the local industries that failed to reflect national industry growth are not identified.

Knowing which industries and occupations are most affected by housing supply problems can be useful in several ways. The businesses that are most vulnerable to adverse risks from housing may be persuaded to become involved in efforts to address shortages. Specific housing needs may be anticipated in local planning. Officials in areas with favorable housing supply conditions can select promising industry targets for development.

Certain characteristics of industries suggest greater sensitivity to housing costs. For example, industries with a greater share of total costs attributable to employee compensation and a larger share of workers in less-skilled, lower-paid occupations are likely to be more vulnerable.

Firms may locate in an area in order to serve the local market, to have access to natural resources or transportation facilities in the area, or because of other attractions, including the presence of other firms.

Businesses that primarily serve local populations tend to be distributed in proportion to population or labor force. Those that serve broader markets, however, will be less evenly distributed among areas. The ones serving broader regional, national or global markets are

referred to as “export base,” “economic base,” or “basic” industries. (See Schaffer 1999; Fujita, Krugman, and Venables 2001, Ch. 3)

Businesses serving regional, national, or global markets may be bound by ties to the labor force, local suppliers, or other factors, but those ties could become frayed if housing and other costs increase, and those activities are potentially mobile. Businesses involved in such activities could relocate to other areas, but more likely there would be a shift in activity to other areas as competitors develop or grow elsewhere and local businesses contract or close.

To the extent that activity shifts elsewhere, it will affect not only businesses in footloose industries but also the businesses serving the local market. Distinguishing between activities that are strictly local and those “exporting” to broader markets will, however, contribute to understanding the impacts of housing supply.

The sections that follow provide some background, preliminary analysis, and research suggestions related to several topics relevant to the understanding of the impacts of housing supply conditions. The topics include:

Industries and Employment
Business Location and Agglomeration Effects
Business Dynamics
Metropolitan Labor Supply
Evident Impacts of Housing

Industries and Employment

From 1955 to 2005, the share of (full-time plus part-time) jobs in goods-producing industries (including construction) fell from 37 percent to 17 percent, with manufacturing industry jobs declining from 27 percent to 10 percent. The non-construction goods share of real GDP actually increased, but disproportionate growth in productivity, along with the fact that more of the inputs used by factories and other goods producers consisted of services rather than materials, changed the mix of employment.

Table A-2 shows the total number of workers and value added by industry in 2005, along with the average share of value added devoted to employee compensation and to taxes (net of subsidies) and gross operating surplus. Value added and compensation per worker are also shown. In capital-intensive industries, such as utilities, employee compensation represents a smaller share, but for many industries employee compensation represents over two-thirds of value added.

For some of the industries with high labor costs, employee compensation per worker is less than lavish, but there are many workers. Other industries face high labor costs with relatively fewer workers, but with more of those workers possessing high skills and receiving high pay.

Table A-3 shows the distribution of employment for industries among major occupational categories. Rows showing average annual wages and salaries and total employment for each occupation, and columns showing similar aggregates for each industry are also included in the table. For industries such as computer manufacturing, data processing, and professional and technical services, more than half of all jobs involve management and professional occupations, with average wages/salaries correspondingly high. The industries with most jobs in low-skilled occupation may be the ones especially sensitive to housing costs.[3]

All industries involve a mix of occupations, and one industry response to high housing costs in particular locations is to separate support activities from those involving key skilled workers. The support work may be done in areas with lower wage rates and housing costs, such as South Dakota or Bangalore. This type of arrangement is facilitated by improvements in communications (See Cohen 2000). Elvery (2006) finds the mix of occupations within industries is skewed toward higher skills in larger metro areas, although

[3] The data in the table come from the BLS Occupational Employment Statistics survey, which collects information from over a million businesses on a rotating 3-year cycle. Information on number of workers, hourly wages, and annual wages are gathered for 801 detailed occupations. Although data for occupation by industry are also collected from households in the CPS, ACS, and decennial Census, the OES data are probably more reliable, and have finer industry and occupation breakdowns.

the analysis does not specifically look for whether there is a link to living costs or whether the same firms place less-skilled work elsewhere.

Business Location and Agglomeration Effects

Industries tend to be clustered in particular areas to a degree that goes beyond the influence of proximity to markets or proximity to raw materials or transportation. This clustering has been attributed to the advantages of "agglomeration." The idea is that the presence of other, similar firms in an area reduces costs or creates other advantages and attractions. The term "agglomeration" has also been applied to concentrations that occur because of the presence of a natural advantage such as mineral deposits, favorable climate, or a body of water, but recent emphasis has tended to fall on the benefits of being around other firms and the entourage of workers, institutions, and infrastructure their presence adds to the locality. To distinguish the specific effects of co-location, the term "agglomeration externalities" will be used here.

Analyses and conjecture extending back at least to Alfred Marshall (1920 {first edition 1890}) have identified agglomeration externalities such as the presence of a cadre of appropriately-skilled workers, the presence of specialized suppliers, and the flow of information derived from the presence of similar firms. Agglomeration externalities have been attributed to concentrations of similar firms (localization economies) and/or to the overall size of the local area (urbanization economies).[4]

Many attempts have been made to explain the micro-foundations of urban agglomeration economies. Duranton and Puga (2004) provide a good review of the micro-foundation literature, which essentially extends along three dimensions: sharing, matching, and learning. Sharing refers to the sharing of indivisible goods and facilities that would be too expensive for an individual or single firm to support, but that become feasible when the fixed costs are spread over many users. Athletic stadiums, markets, and airports are common examples. Another form of sharing is the sharing of risk though labor pooling. Matching refers to the productivity gain when a worker has the right experience to meet the specialized needs of the employer. Matches should improve because there are more

[4] The argument for urbanization economies is typically attributed to Jacobs (1969), and such effects have also been termed "Jacobs externalities."

agents trying to make a match (Helsley and Strange 1990). A better match between worker and employer reduces the need for turnover and re-training. Firms devote substantial resources to learning and innovation. Interaction with like-minded researchers, whether private, academic, or government employees, promotes the diffusion process.

The presence and relative importance of localization economies and urbanization economies has been debated in the literature (Strange 2005; Rosenthal and Strange 2003, 2004; Shefer 1973; Moomaw 1981; Tabuchi 1986; Ciccone and Hall 1996, Wheaton and Lewis 2002).

As an empirical matter it may be difficult to distinguish the effects of agglomeration externalities from the advantages of a location that would be present even if there were no other similar firms present. The hypothesis that there are benefits from agglomeration independent of the natural resources becomes, after all, that many firms are there because many firms are there. Some attempts have been made, however, to distinguish between natural advantage and agglomeration externalities (e.g., Ellison and Glaeser 1999; Chatterjee 2003).

A common measure used to identify industry concentration is the "location quotient." A metropolitan area's location quotient for an industry may be calculated as the industry's share of total employment in the area divided by the industry's share of national employment. Thus, if 25 percent of workers in an area worked in manufacturing, and 10 percent of national employment was in manufacturing, the location quotient for manufacturing in that area would be 2.5. Location quotients substantially above 1.0 suggest an export base industry, although relatively high location quotients could just reflect high local demand, and some industries with low location quotients may primarily serve customers outside the local area.

Table B-1 shows the range of location quotients for the 100 largest metropolitan areas for various industry categories. Location quotients could not be calculated for every industry in every MSA, because employment was not reported uniformly. The column labeled "reporters" shows how many MSAs had data. The table includes the lowest value, the 10th percentile, median, 90th percentile, and highest value for those MSAs that reported. As expected, the range of values is narrower for industries like retail trade that primarily serve

the local population, while industries that serve broader regional, national, or global markets have a wide range of location quotients.

The column labeled “combined” reflects total large-metro industry employment as a share of total overall employment, based only on the MSAs reporting employment for that industry. For example, among the largest 100 MSAs, data for employment in Fabricated Metals Manufacturing were reported for 88 MSAs, which collectively had 882,000 private Fabricated Metals jobs among 81,592,000 total non-agricultural payroll jobs in 2005, or 1.08 percent. Fabricated Metals represented 1.15 percent of national employment, so the combined location quotient was 0.94 (1.08%/1.15%).

The 12 MSAs for which employment in Fabricated Metals was not reported probably had smaller shares of employment in the industry than those for which data were available, so the combined LQ in the table is probably biased upward. Even so, the location quotients shown for manufacturing industries and for other goods-producing industries (except construction) are generally less than 1.0. Goods-producing industries are more likely to be located in smaller metropolitan areas or in nonmetropolitan areas. For most manufacturing industries, location quotients for large metropolitan areas were already less than 1.0 in 1990, and the shares of industry jobs in large metros declined further between 1990 and 2005. Notable exceptions include apparel and computers, where substantial employment declines in large metropolitan areas were exceeded by even greater reductions in nonmetropolitan areas.

Location quotients are a simple and popular measure of industry concentration, but are crude statistics. Extreme values will be more common for areas with less total employment and/or for industries where individual establishments are large (Ellison and Glaeser 1997; Naude 2006). For the large MSAs and aggregated industry groups shown here, that should not make a huge difference.

Location quotients measure the degree to which a particular area has a disproportionate share of an industry, not the degree to which an industry is concentrated in a few areas. The distribution among areas of location quotients provides some indication of the degree of concentration of an industry, but there are other, possibly superior, measures. One possibility is to use Gini coefficients, similar to the way such statistics are used in analysis of income inequality (Krugman 1991). More sophisticated methods incorporating adjustments

for plant size have been developed by Ellison and Glaeser (1997) and Maurel and Sedillot (1999).

The concentration of people with high income and wealth, and perhaps skill, in "Superstar" cities such as San Francisco and Boston where housing supply has been constrained has been documented by Gyourko, Mayer, and Sinai (2006). They find that in-migration to such places is heavily skewed toward high-income people. They don't find equally compelling evidence that out-migration is skewed toward low-income people. The relationship of housing supply to the concentration of high-skilled people and to income distribution among areas was not found to be significant in studies such as Berry and Glaeser (2005). But Glaeser elsewhere (2006) expresses the opinion that there is an effect, such that "in the long run, firms generally leave high-cost areas."

Concentrations of industries, and indeed, the locations of cities, reflect history. There are a variety of factors such as investments in fixed capital and moving costs that would tend to perpetuate industry concentrations even after the influences or happenstance that created them are gone. But compared to location choices based on local service functions or immovable resources, the clusters caused by agglomeration externalities may be more changeable.

Several of the key theorists of agglomeration economics and "New Economic Geography" indicate the possibility of "catastrophic bifurcations" (Fujita and Mori 2005) under which "the agglomeration collapses suddenly" (Strange 2005). These descriptions generally refer, however, to the properties of abstract models, rather than to any particular real-world experience (Martin and Sunley 1996).

The New Economic Geography literature is a variant on agglomeration economies in that firms are assumed to have increasing returns to scale. Based on a *Journal of Political Economy* article by Paul Krugman (1991), New Economic Geography (NEG) models are distinguished by five essential ingredients (Head and Mayer 2004):

1) Increasing returns to scale based on fixed overhead that are internal to the firm.
2) Imperfect competition, usually some form of monopolistic competition with limited pricing power.
3) Trading costs for transport and sale of inputs and outputs.

4) Endogenous firm locations, entry and exit based on expected profitability with increasing returns to scale favoring large plants serving their customers from a distance.
5) Endogenous location of demand, consumption is mobile either because workers consume where they work or firms use the output of other firms as intermediate inputs.

The net effect of these five ingredients, especially the endogenous location of demand, is that agglomeration effects build up some regions and pass over other regions largely independent of the original distribution of natural resources. Natural advantages and human capital externalities are alternative explanations for uneven economic development. The emphasis of NEG is on economic development through trade built up from production based on increasing returns and distribution limited by trading costs. Land use regulation fits into the NEG perspective in that regulation can add significantly to the fixed cost of a project, whether commercial or residential. Not only does zoning restrict where firms can locate production and distribution facilities, but the requirements for linkage fees, extensive impact assessments, and protracted negotiations mitigate against small-scale development.

One of the implications of NEG models is that wages should vary by region according to the market potential of that region, especially in trade with surrounding areas. Hanson (1998) estimates a log wage equation in which wages for a given county are determined by the trade potential with surrounding counties as captured by their personal income, wage rate, and housing stock. Essentially, if people in other counties had more income to spend on non-housing consumption, their demand would increase the own-county wages. Although the model fits the spatial variation in wages reasonably well and validates the NEG theory, the expenditure share on the traded good is estimated between 0.91 and 0.97. These values leave too little room for expenditure on housing, the non-traded good.

Hanson's market potential model is estimated assuming that trade costs are a power function of distance, but this implies that demand shocks disproportionately affect wages and house prices in nearby regions. Hanson (1997) estimated Mexican wages following trade liberalization with the U.S. That study shows that a 10 percent increase in distance from employment centers in Mexico City reduces wages by 1.92 percent and the same increase in distance from the U.S. border reduces wages by 1.28 percent.

Kim (1995) estimates the relationship between industry concentration and scale economies using panel data on manufacturing over the very long run, 1860 to 1987. Regional specialization rose from 1860 to the turn of the century and remained stable before declining after the Second World War. Kim regresses Gini indexes for twenty industries with 2-digit NAICS codes on the number of production workers per plant (as a proxy for internal scale economies) and the ratio of raw materials to value added (as a proxy for resource intensity) along with industry and year fixed effects. The positive and significant coefficient on the proxy for scale economies supports the NEG model and shows that increasing scale industries are associated with spatial concentration. However, when examining European economies, Brulhart (2001) finds no significant relation and Haaland, Kind, and Midelfart-Knarvik (1999) find a negative impact of scale on concentration.

Ottaviano and Thisse (2004) provide another view of NEG models in that small shocks can have permanent impacts on the economic landscape. The putty-clay nature of economic geography seems to capture a fundamental aspect of modern economies and planning decisions. The researchers write (p. 2603), "the steady fall in transport costs seems to allow for a great deal of flexibility on where particular activities can locate, but once spatial differences develop, locations tend to become quite rigid. ...Nonetheless, we have also seen that such an extreme agglomeration may give rise to various forms of price differentials that can trigger a process of redispersion, or that more sophisticated migration behavior may prevent the emergence of a single core." The net effect is that it can be very difficult to predict long-run land use patterns even though they are stable during intervening periods. The industrial revolution brought a major shift toward urbanization and specialization, but following that revolution there have been long cycles of convergence and divergence. The dominant expectation in the mid-twentieth century was probably that regional economies would become more alike, rather than more specialized. With advances in transportation and communications, and with decreased shares of employment tied to immovable natural resources, some analysts documented and/or predicted regional convergence (Hoover and Giarratani 1984, Ch. 11; Garnick and Friedenberg 1982, Barro 1991). Regional industrial structures generally became more similar from the 1930s until the 1970s (Kim 1995), and income differences among regions narrowed. Since about 1980, however, there has been no clear overall trend toward convergence or divergence in incomes or industrial composition (Bernard 1996; Gutierrez 2001; Bernat 2001; Holmes and Stevens 2004).

Business Dynamics

Net growth in local area employment in each industry is the result of much larger gross flows, with increases in employment due to the creation of new establishments and expansion of some existing establishments, offset by reductions from contractions or closures of other existing establishments. Relocations of businesses into or out of the locality could also contribute.

Recently, with the creation of several new data bases (Parker 2006; Neumark et al. 2006a, 2006b; Acs and Armington 2005) there has been a surge of research regarding establishment and employment dynamics. Except for work using a private data set constructed from Dun and Bradstreet records (e.g. Neumark), this research has been conducted by employees of the Bureau of Labor Statistics or Census Bureau, or by researchers granted special access to the confidential microdata.

Most of the recent work has not focused on differences among local areas. Research using the new Census and BLS data has most commonly been at the national level (Butani 2005; Davis 2006a, 2006b; Figura 2006; Knaup 2005; Spletzer 2004; Clayton 2006; Pinkston 2004; Yashiv 2006). Some studies have documented dynamics for specific areas, but have not compared areas across the nation (Neumark 2006a, 2006b; Faberman 2001, 2002; Spletzer 1998). Of those that have compared geographic areas below the national level, most have used states rather than metropolitan areas (Abowd 2003; Benedetto 2007; Foster 2006; Rigby and Essletzbichler 2000).

During short-term periods, expansions and contractions of existing establishments account for most employment change, but measured over several years, the creation of new establishments and closure of existing establishments is the main influence.

Failure rates are high among young establishments. Survival rates rise with age, at least after the first few years (Caves 1998; Figura 2006; Dunne 1989, 2005; Headd 2001; Nucci 1999). Despite high closure rates among young establishments, high entry rates and high growth among surviving young firms are typically key factors in local areas with high employment growth (Faberman 2006; Neumark 2006a).

Overall closure rates tend to be as high, or higher, in growing areas as in declining areas (Greene 1982; Faberman 2006). High closure rates of young establishments may obscure relative closure rates across among metropolitan areas, because areas with healthy economies and high growth have more failure-prone young firms, possibly offsetting high survival rates among older area firms. Faberman (2006) not only finds that the presence of young firms raises the closure rate for an area, but that in the fastest-growing areas the failure rate among young firms is higher than for young firms in less-dynamic areas where growth is slower.

Although businesses may move to new quarters within a metropolitan area, relocations between areas do not appear to be common. Most studies of business dynamics have not considered relocations, but the studies that have measured moves conclude that inter-area relocations represent a very small share of changes in employment (Neumark 2006a, 2006b; Greene 1982). Perhaps, for multi-establishment firms, there are some stealth relocations, where a new establishment is opened in another area and at some later point the original establishment is closed down. Even if these situations were included, however, most of the net growth in an area, and most of the transfer of activity among areas, would appear to be related to entry and exit of new firms or branches.

Many of the studies of business and employment dynamics have been limited to manufacturing (e.g., Davis, Haltiwanger, and Schuh 1996; Rigby and Essletzbichler 2000; Dumais, Ellison, and Glaeser 2002; Foster 2006). For example, Dumai, Ellison, and Glaeser (2002) use data from the Census Bureau's Longitudinal Research Database on U.S. manufacturing industries. The researchers find that plant births reduce agglomeration while plant closures reinforce agglomeration. Another curious finding is that concentrated industries are just as mobile as un-concentrated industries. The agglomeration of an industry does not seem to inhibit movement through the balance of new plants and closing firms.

The dynamics in non-manufacturing industries may be quite different (Acs and Armington 2005; Anderson and Meyer 1994; Foote 1998). With manufacturing industry jobs representing only about 11 percent of national employment and an even smaller share in major metropolitan areas, studies of manufacturing may appear to be of little interest. Certainly, information based on all types of businesses is preferable, but manufacturing plants tend to be part of the export base of local economies, even where location quotients

are not high. Moreover, manufacturing is generally more labor-intensive and uses more locally sourced inputs than some other export base industries such as mining or long-haul transportation. Thus, manufacturing may perhaps deserve special attention.

Business data are generally collected and reported on either an establishment basis or a firm/enterprise basis. An establishment is a single location where business is conducted or services provided. A firm or enterprise may consist of a single establishment or of multiple establishments. Most firms consist of a single establishment. Multi-establishment firms represent less than 5 percent of employer firms and include only about a quarter of establishments, but they provide the majority of jobs (Butani 2005; Acs and Armington 1999, 2005).

Chapter Three: Metropolitan Labor Supply

Adverse impacts of constrained housing supply and high housing costs on employers will take the form of labor supply problems. Local labor supply problems are not easily identified, however. In contrast to the mountains of data and extensive analyses with respect to whether workers can find jobs, there is a dearth of information about employers' ability to find workers and their costs for doing so.

Housing-related constraints on labor supply will occur largely through effects on net migration. This is both because housing supply has greater impact on net migration than on the labor supply response of the existing population (in the form of changes in the labor force participation rate or unemployment rate) and because net migration is the key determinant of overall changes in labor supply for metropolitan areas, at least in the long run.

Blanchard and Katz (1992) examined the effects of employment shocks and reported that "by five to seven years, the employment response consists entirely of the migration of workers." That may be an extreme view, but Bartik (1993) reviews a number of other studies and finds that most estimates of the migrants' share of new jobs range from 60 percent to 90 percent in the long run. Reduced unemployment rates and higher labor force participation rates in areas with job growth are partly attributable to in-migrants with higher labor force participation rates and employment rates than incumbents.

An alternative source of labor, rather than migration or increased employment among local residents, could be commuting from other metropolitan areas or from nonmetropolitan areas. In the compact geography of European countries, a trade-off between migration and commuting has been given considerable attention (e.g., Ommeren 1999; Cameron 1998, 2006; Elliason 2003; Gordon 1998; Jackman 1992).

In the U.S., there has been recent growth in "extreme" commuting, defined by the Census Bureau as traveling 90 minutes or more getting to work (Census Bureau Press Release March 30, 2005; Pisarski 2006; Paumgarten 2007). Data from the 2005 American Community Survey show that among people employed in Metropolitan Statistical Areas (MSAs), 91 percent also lived in those MSAs, with most of the remainder coming from adjacent MSAs, often within a broader "Combined Statistical Area."

Although MSAs are defined as counties or groups of counties based on commuting patterns, indicating that they represent integrated labor and housing markets, congestion and mismatched jobs and housing may adversely affect the supply of labor even from within the area. That topic is explored in a separate section.

Identifying Labor Supply Problems

The symptoms of labor supply problems encountered by employers may include higher wages, higher non-wage compensation, unfilled jobs, and higher costs for recruitment. Productivity may suffer, but the negative effects on productivity may be obscured if labor-intensive lower-skilled tasks are shifted to other locations or if employers invest in more equipment to substitute for labor. In that case labor productivity may appear to be better than average, even though total factor productivity is substandard.

Of the various indications of adverse local labor supply conditions, the most visible may be wage rates that are higher than elsewhere. Wages for seemingly-comparable workers and jobs are generally higher in places with high house prices. The higher wages have been interpreted, in some analyses, as reflections of higher productivity generated by agglomeration externalities, or as due to unmeasured but valuable characteristics of workers, especially highly educated white-collar workers (Glaeser-Mare 2001, Berry-Glaeser 2005, Peri 2002). Such interpretations imply that the higher wages do not represent higher marginal unit labor costs, and therefore the absence of adverse impacts on employers.

Information about non-wage compensation is generally available as well. The principal components of non-wage compensation are health insurance and retirement benefits. Some benefit costs are related to wage levels, or to local costs. In general, however, they may be less influenced than wage rates by constraints on housing and labor supply.

To the extent that employer-assisted housing benefits are an element in non-wage compensation, the cost of those benefits could represent a significant impact of housing supply conditions on employers. Housing-related benefits are rare, however, except perhaps as an element in relocation packages. The incidence of such benefits is unknown, but their infrequency is implied by the fact that they do not even garner a footnote among

the benefits enumerated in the BEA National Income and Product Accounts or the detailed catalog of benefits from the BLS National Compensation Survey.

Labor supply constraints could be manifest in unfilled jobs. There is less information about unfilled jobs, however, than about employers' costs for wages and benefits. There is also much less information about unfilled jobs than about unemployed workers.

The availability of information about job vacancies, as well as about hiring and separations, has been enhanced by the creation of the BLS Job Openings and Labor Turnover Survey (JOLTS). Information is collected on a monthly basis from about 16,000 establishments regarding total employment, job vacancies at the end of the month, employees added to payrolls during the month, and the number who quit or are terminated. So far, JOLTS data for major industry groups has only been presented at the national level and analyzed mainly in terms of changes over time. Overall totals (without industry detail) are also reported for four broad regions.

Since JOLTS information is not reported below the broad regional level, it has been impossible to use for analyzing labor supply and job vacancies in metropolitan areas. The principal excuse given for this lack of geographic detail is that the 16,000 sample is too small. Although the sample includes only about 0.2 percent of eligible establishments, the sample establishments employ over 12 million workers—nearly 10 percent of the relevant employees. The Current Population Survey, used (along with some other information) to produce annual benchmarks for local area labor force and unemployment estimates, collects information from a sample of about 60,000 households, which include fewer than 100,000 workers.

It may be possible for BLS staff or for researchers granted special access to use unpublished JOLTS microdata for analysis. Several interesting studies that go beyond the information in the published data have been conducted on that basis (e.g., Davis 2007). Even if local vacancy data were available, it may be difficult to identify labor shortages or other problematic labor supply conditions. The job vacancy rates by industry reported at the national level do not appear to be consistent with employee perceptions of the tightness of labor supply. For example, during the recent housing boom, when home builders were reporting widespread labor shortages, the JOLTS data showed construction as having low vacancy rates.

In analyzing job vacancies, there may be benefits to applying some of the analysis that has been conducted regarding housing vacancies. It is likely, for example, that equilibrium job vacancy rates for an area or occupation would be lower where the average job tenure is longer.

Although the primary research direction for assessing and documenting the effect of housing supply on labor supply should involve looking at relationships between wages or vacancies and housing supply, there is also a need from both a housing market and labor market standpoint to better understand the symptoms of problematic labor supply from the employers' standpoint. One possibility would be to develop comprehensive survey data to measure subjective labor supply concerns and relate those measures to the data on wages, vacancies, turnover, etc.

The number of vacant positions will generally be higher when the unemployment rate is lower. The relationship between job vacancies and unemployment is represented by the Beveridge Curve (Blanchard and Diamond 1989; Bleakley and Fuhrer 1997; Valletta 2005, 2006; Abraham 1987). But low unemployment rates are an imperfect indication of the supply of workers available to employers.

In the absence of vacancy data prior to the availability of the JOLTS, a number of analysts constructed estimates of the Beveridge Curve using the Conference Board Help-Wanted Advertising Index and other fragmentary data. The results indicated that the curve shifted outward from the 1960s until the mid-1980s, with more unemployment relative to the level of vacancies. The curve then apparently shifted inward, suggesting more efficient matching of workers with jobs.

Explanations for the outward shift of the Beveridge Curve in the 1960s and 1970s include entry into the labor force of young and inexperienced workers. Bleakley and Fuhrer (1997) cite adjustments following absorption of the baby boom and of increased female labor force participation as plausible causes for increased matching efficiency and decreased level of churning and the inward shift of the curve beginning in the 1980s.

In addition, divergence in regional economic conditions, followed by more uniform employment growth and unemployment rates among localities, have been identified as

major factors (especially by Abraham 1987 and Valletta 2005). It is obviously harder to fill vacant jobs with unemployed workers if they are in different places.

The relationship between job vacancies and unemployment represented by the Beveridge Curve is related to the concept of a natural unemployment rate and a non-accelerating inflation rate of unemployment (NAIRU). If unemployed workers cannot be efficiently matched to jobs, market friction and anti-inflation monetary policy will mean higher overall unemployment rates (Brauer 2007, Katz 1999).

Housing and Net Migration

Although areas with favorable climate and other amenities will attract migrants from less-blessed locations, those attractions are relatively static "fixed effects" and the driving force for changes in migration of the working-age population will generally be wages and employment opportunities, offset by living costs, of which the cost of housing is the most important.

Despite the theoretical and empirical significance of housing supply/cost in explaining migration, it is not uncommon for models of migration to ignore housing cost or to assert that housing costs are captured by crude measures of overall costs of living, such as those constructed from regional versions of the consumer price index. In other cases, housing costs were tested and found to be insignificant. Migration studies have often been based on states or regions, and housing supply effects may be weaker at that level of geography. According to Cameron et al. (2005), however, "leaving out housing market effects typically results in misspecified models in which labour market effects are estimated as weak or even perverse in direction."

One of the difficulties with estimating the effect of housing cost on migration is that housing costs reflect the quality of life in an area (Ezzet-Lofstrom 2004; Clark 2004; Fu 2005b; Rosen 1979), as does migration. In a cross-sectional analysis, this could mean that people appear to prefer to migrate to high-cost areas. There are two main approaches to dealing with this. One is to measure the effects of changes in house prices (and/or wages) assuming that quality of life doesn't change much over the short term. The other is to include variables that may be measures of quality of life, such as climate, crime rates, or air quality.

Some migration models are built on the idea that, given differences in area amenities, there will be adjustments in local area wages, house prices, etc., to produce equilibrium where migration is minimized. This approach is more common in Europe, where mobility rates average roughly half of those in the U.S. and adjustments in the housing supply occur more slowly. Such European studies typically include envious references to U.S. conditions that are seen as more responsive to regional economic imbalances and better able to move workers to jobs and add housing supply where needed, growing regional differences in unemployment rates and raising productivity (e.g., Vermeulen 2005; Cannari 2000; OECD 2005). The ideas of equilibrium versus disequilibrium models for migration are described in Goetz (1999).

In considering the effects of housing supply on net migration, there is some question as to the appropriate measure of housing cost or availability. Rents may perhaps be most appropriate, since movers (both local and inter-metropolitan) tend to be younger than non-movers and (even after adjusting for age) are less likely to be homeowners.[5] Migration models using rents or implicit rents include Berger (1992).

The case of rental housing is easier to define and measure than the cost of owner-occupancy, but there are still measurement problems. Adjusting for quality (including location as well as size and amenities) is one challenge. Moreover, the average rent paid by current residents may not accurately reflect the rents available to in-migrants. That distinction exists in private rental markets, but is most significant where rental housing is subsidized or publicly owned.

Most recent migration studies incorporating housing cost have used measures of the cost of owner-occupied housing, rather than rents. In some cases (e.g., Cannari 2000) house prices were used because of perceived deficiencies in data for rents. The price of owner-occupied housing has been portrayed by price levels (with or without quality adjustments), prices relative to incomes, and/or user cost (either explicitly or implicitly through inclusion of appreciation rates). Gabriel et al. (1992) found house prices more statistically significant

[5] According to the March 2005 Current Population Survey, among persons aged 5 and over who did not move between 2000 and 2005, 85.7 percent lived in owner-occupied homes, compared to 52.5 of all movers and 51.8 percent of domestic interstate movers.

than user cost, interpreting this as due to cash flow or liquidity constraints. Murphy (2006) found both price levels relative to income and appreciation rates important to regional UK migration, but found that in Greater London, the absolute supply (relative to population) was more important than cost.

The perceived user cost facing migrants or other home buyers largely consists of expectations of house price changes. User cost variables in models of migration typically assume that expected appreciation is equal to actual appreciation in the preceding one to three years. The potential in-migrants from areas with stagnant prices may, however, have formed different expectations of house price changes, for both origin and destination areas, than existing residents in possible destinations. Murphy (2006) includes expected house price change for each UK region based on a "semi-rational" equation incorporating incomes, stock market prices, and interest rates, as well as recent changes in the region, in contiguous regions, and in Greater London.

U.S. Migration Studies

Berger and Blomquist (1992) studied county-level migration during 1975 to 1980. They calculated separate estimates of the probability that an individual would leave a county and the probability that movers would choose specific destination counties. Housing costs were represented by quality-adjusted rents and imputed rents. The models also included demographic characteristics of the individual, county quality of life measures, and wages. In the estimate of the probability of moving away from the initial county of residence, the rent measure had the expected sign (i.e. higher rent was associated with high outmigration) but was not statistically significant. In the choice of destination county, however, rents were highly significant. This is consistent with other studies indicating that housing costs affect gross in-migration more than gross outmigration.

Gabriel, Shack-Marquez, and Wascher (1992, 1993) used migration data for nine divisions (New England, South Atlantic, Pacific, etc.) between 1980 and 1981 and between 1986 and 1987. Since there are widely divergent housing supply conditions within such broad areas, it is difficult to assess the impact of local housing supply constraints, but they still found that house prices significantly affected migration among those regions, with migration from low-cost regions to high-cost regions, in particular, constrained. They tried data for the level of prices in the origin and destination regions, as well as a measure of user cost incorporating

price changes in the preceding 3 years. The level of prices in the destination region showed the strongest and most consistent effects.

Frey and Liaw (2005) analyzed gross interstate migration from 1995 to 2000. They represent housing cost as the average of median value in 1990 and 2000. A slope dummy distinguishes housing value for individuals with and without college educations. The results show a significant impact of high house values on the probability of leaving a state, and an even greater influence on the likelihood of moving to a state—but only for those without a college education.

Foreign Migration Studies

Bover, Muellbauer, and Murphy (1989) describe how housing price differentials between the high-cost South East and the rest of the U.K. impede migration (p. 130):

> "The 'mobility trap' caused by an upswing in aggregate housing demand operates as follows. As the relative appreciation of their house prices gathers pace, households in the South East (UK) initially become more reluctant to move to other areas. They fear that they would miss out on further relative appreciation and that they may not be able to bridge the house price gap should they subsequently wish to return. Thus, relatively few housing slots are freed for potential migrants to the South East, and this causes further relative appreciation. As it continues, households outside the South East become increasingly unable to bridge the gap between whatever equity stake they may already have in housing and the price of a house in the South East."

As the housing price/earnings differential nears a peak, out-migration from the high-cost area picks up, housing supply is catching up, speculative investment is increasing, and in-migration is stalling from credit constraints. At this point, the market is vulnerable to an adverse housing demand shock. If such a shock occurs, as it did in 1973-75, the premium for South East housing could fall as speculative expectations reverse. At the peak and post-peak points of the housing price cycle, firms have a particularly difficult time keeping or hiring workers. House prices are either too high or projected to soften, so workers are either unable or reluctant to buy into such a market. And many existing workers want to sell out of the market before it starts to fall. The historical record shows that in 1973, there was a 25-year peak net outflow from the South East of 69,000 with subsequent large net out-

migrations in 1974 and 1975. Bover, Muellbauer, and Murphy suggest that firms also participated in the exodus, frustrated by high wages, labor shortages, and high land costs.

There was concern in the UK about the ability to respond to regional labor requirements because of immobility of social/council (public) housing residents, as well as the less-extreme immobility of homeowners, particularly following the conjecture by Oswald (1996,1997) that ownership increased unemployment. House price differentials were seen as exacerbating transactions costs for owners. Cameron and Muellbauer (1998) claimed there is a solid body of research showing that high relative earnings and employment opportunities encourage in-migration while high relative house prices discourage in-migration, writing "As owner-occupation has risen, the evidence is that the influence of relative house prices on net migration rates has risen also." More recently, Murphy, Muellbauer, and Cameron (2006) claim that "high house prices choke off migration caused by strong labour market conditions."

Hamalainen and Bockerman (2004) discovered that an increase in the internal turnover of jobs in regions of Finland was associated with an increase in net-migration. Because of housing market constraints to in-migrants, the response to strong labor markets was primarily through less out-migration.

Cannari (2000) considered the effects of housing costs on migration from the south of Italy to the north. Despite continued superior incomes and employment opportunities in the north, migration slowed sharply after the 1960s. Growing differences in quality-adjusted house prices were found to be a significant explanation.

Vermeulen (2004, 2005) looked at several European countries and concluded that housing cost differences offset the incentives to migrate to areas with lower unemployment, allowing differences in unemployment rates to persist for extended periods. They argue that lower house prices provide such significant compensation for higher unemployment that E.U. subsidies to economically depressed areas are not justified.

Evident Impacts of Housing

In most U.S. markets, housing supply conditions may not have major, obvious impacts on labor supply and the ability of local businesses to compete with firms located elsewhere in the U.S. Under more extreme conditions, the role of housing as critical infrastructure becomes manifest.

Although surveys have found that housing is a factor in business location decisions, it has rarely been identified as one of the most important factors (Gottlieb 1994; Salvesen 2003; Gambale/Area Development 2006a, 2006b; Czohara 2004) and is often not even mentioned (Expansion Management 2007). The only surveys where housing has gotten major attention have been in the most expensive areas, such as Silicon Valley or Boston (Gerston/Silicon Valley Leadership Group 2006; Boston Globe survey cited by Bluestone 2006). Although housing in much of California is only marginally more affordable and plentiful than in the Bay Area, statewide surveys have not placed housing among the biggest concerns of business (Baldassare 2007; Bain/California Business Roundtable 2004). In fact as part of this research we conducted interviews to systematically assess the prevalence of employer problems suggested to be caused by the high cost and limited availability of housing. None of the businesses interviewed identified that the cost of housing was a primary consideration in location selection, or of primary concern.

The first real involvement of the U.S. Federal government in housing supply came during the mobilization for World War I. The president of Newport News Shipbuilding told Congress "You cannot get ships unless houses are provided for workmen" (NY Times 1/10/18). Within a few weeks Congress appropriated funds for the acquisition of housing and loans to developers around shipyards, and President Wilson was authorized to commandeer lumber and move tenants who were not working in shipyards out of nearby hotels and boarding houses. The Ordnance Department separately diverted funds out of their production budget to "industrial housing" located "near isolated explosive and bag-loading plants" (Colean 1940).

In other countries where housing markets were recently less fluid than in the U.S., the impacts of housing supply on labor supply and economic efficiency have been clearly demonstrated. Several studies analyzed conditions in Poland in the 1970s and 1980s, and found that housing shortages and rent controls (influenced by Marxist theory considering

housing to be unproductive) impeded labor mobility and productivity (Mayo and Stein 1988; Pogodzinsky 1995; Hacker 1999).

While not as severe as in Poland, sclerotic housing markets in the U.K. have been identified as a constraint to matching labor and jobs, with a lack of housing in the booming Southeast affecting labor supply and business locations, and contributing to national unemployment (TZ Consulting 2006; Murphy, Muellbauer, and Cameron 2006; Barker 2004; Hughes and McCormick 1987).

Other studies from Europe have indicated that high housing prices in areas of labor shortage, and low prices in areas of labor surplus, have impeded labor market adjustments through migration. These include Vermeulen (2005), Hamalainen (2004), Cannari (2000), and Duffy (2005), with regard to the Netherlands, Finland, Italy, and Ireland, respectively.

Hurricane Katrina in 2005 destroyed more housing than any previous natural disaster in the U.S. Estimates of the number of units destroyed are in the range of 200,000, compared to less than 30,000 from Hurricane Andrew in 1992 or the San Francisco earthquake and fire in 1906. This tragedy provides a basis for more fully exploring the link between housing supply and economic potential and efficiency. So far, most of the evidence has been anecdotal. (See stories regarding Oreck in NY Times 1/15/07; PBS 2/7/07; "Ship Shape" N.O. Times-Picayune 12/3/06.)

Needed Research

- Direct measure of export base/non-local customers
- Labor shortage measures – metro area vacancies, recruiting costs
- Compilation of an additional survey data determining whether employers in different areas and industries perceive labor supply problems, and relate those results to statistics on wages and vacancies.
- New research on the effects of housing on workforce migration, concentrating on metropolitan areas and types of workers
- Documentation of the impacts of extreme housing supply conditions (e.g., New Orleans) on businesses

Chapter Four: Labor Productivity

Business executives are concerned about the effects of housing on labor productivity, recruitment, and retention. When local housing is expensive, firms must pay workers nominal wages high enough so that the real wages (adjusted for the value of local amenities) are comparable to other employment centers. Workers who can find higher wages or lower housing costs are likely to leave their current job for the higher real wages. Therefore, the literature review on labor productivity begins with wage models and measures of turnover. Labor is differentiated by education and training, and the skilled workers (college-educated) are often considered the driving force in business growth. To attract skilled workers, businesses seek locations where skilled workers already live and work. A robust literature has developed around spillover effects, agglomeration effects, and the density of cities. All of these factors affect labor productivity and the co-location choices of firms and workers.

Another set of literature focuses on the spatial mismatch and job search. Rising house prices may force some workers to seek affordable housing far from their employment site. The spatial mismatch literature grew out of concern that minority workers lived far from job centers, which would reduce their opportunities to find employment. The suburbanization of jobs has reduced the spatial mismatch for some non-minority workers, but increased the spatial mismatch for many minority workers. Spatial mismatch research goes beyond racial/ethnic differences to include income class differences, which generally align with education and wages. If employment cannot be found within commuting distance, workers can migrate to other metropolitan areas seeking workers. The review of the migration literature considers the differences in search patterns between skilled and unskilled workers as well as the labor market dynamics as workers respond to market disequilibrium.

Long commutes are more liable to delays or breakdowns that can lead to worker absences and lost productivity. Traffic congestion has led some firms to relocate away from downtown properties, which has created a challenge for public transit systems and workers without cars. Although there is a vast literature on transportation, this review focuses on how accessibility has affected the size of the “labor-shed” and the jobs-housing balance.

The size and shape of a metropolitan area depends partly on growth controls and land use regulations. Tight land use regulations also reduce the supply elasticity of housing and

channel the demand into higher house prices rather than more houses and workers. Short-run adjustments are made through house prices and rents. In the medium term, businesses must respond with higher wages to retain their workers. In the long term, growth occurs in less restricted areas that can accommodate more houses and more jobs. A related literature, nexus studies, has developed from California law, which attempts to measure how a new development will affect the availability and affordability of housing. Nexus studies often are used to justify linkage fees charged to developers by local governments. The fees can channel development and may offset some of the externalities associated with new development.

The logical extension of studying land use patterns is the debate over sprawl and smart growth. Although sometimes portrayed as a conflict between developers and planners, the debate attempts to weigh the costs and benefits of density on commuting, pollution, energy use, agricultural land consumption, income segregation, infrastructure, fiscal expenditure, and personal health. The goal in this literature review is not to settle the debate, but rather point out how it touches on the accessibility, availability, and affordability of workforce housing.

A number of papers take a broad view of economic development at the regional level, considering employment, housing, transportation, migration, and fiscal impacts. This research includes case studies of specific regions recognizing the historical patterns of development and projecting how the region could be improved in the future. Although it is often difficult to translate the findings of these regional case studies to other places, the richness of the detail highlights the forces at work.

This chapter is divided into four sections: wage models, turnover, education and training, and returns to skill. Each section concludes with some ideas about further research that would highlight the role of land use regulation on worker productivity. Productivity has traditionally been measured in the context of a wage demand equation derived from the production function. Thus, wage models are a logical place to start.

One approach to examining the effects of land use regulation is to see if those regulations are related to either the wages paid or the rate of labor turnover. Much of the recent labor literature has focused on the increased differentiation between skilled and unskilled labor, often distinguished by the degree of education. Cities with a high share of skilled workers

seem to be places where new industries grow and all workers benefit through higher wages. One explanation for the higher wages is the knowledge spillovers among workers and firms.

Wage Models

In neoclassical economic models, labor demand is derived from the production function in which profits are maximized by paying labor its marginal product. Labor productivity can be increased by increasing the amount of capital per worker or by improving how the workers are combined with capital and technology or total factor productivity. Shapiro and Stiglitz (1984) suggest another way, i.e., paying the workers a higher wage or efficiency wage. Workers being paid no more than what they would receive at their next best job are not too concerned about losing their job. Assuming that the worker has some knowledge that has been customized for his or her current employer, that knowledge is lost when the worker leaves the firm. Another worker must be trained as a replacement and the overall productivity of the firm suffers during the retraining period. By paying the worker a slightly higher wage, the firm maintains higher productivity to justify the higher wage, and the worker does not shirk his responsibilities in order to keep his job.

Akerlof and Yellen (1990) developed the fair wage-effort hypothesis, which is a variant of the efficiency wage model. Workers form a notion of the fair wage based on the pay and effort of their co-workers and neighbors. If the actual wage paid is lower than what the worker perceives is a fair wage, the workers withdraw effort in proportion. Depending on the wage-effort elasticity and the costs to the firm of low effort, the fair wage becomes a factor in the wage bargaining. Krueger and Summers (1988) explain the variation in wage scales across industries in the context of fair wages. If firms must pay high wages to certain workers, either because they are in short supply or because of the sensitivity of total output to their efforts, demands for fairness may spread the high wages to all working in those firms. Wages of other workers in the firm will be paid more than in other firms, and similar patterns develop throughout an industry.

Another explanation for wage differentiation is provided by Diamond and Simon (1990) who claim that workers demand higher wages in more specialized cities. Worker productivity is increased by the greater specialization, but that specialization also increases risk from a drop in demand for the output of that industry. To compensate for that risk, firms in the specialized city must pay the workers a premium. Workers in a large city with diversified

industries face a lower risk of job loss and a better chance of finding alternative employment during a slump.

To test these theories about wages and labor productivity, Hellerstein, Neumark and Troske (1999) combine data on individual workers and their employers to calculate estimates of marginal productivity differentials for different types of workers. Generally productivity is inferred from a wage equation based on the assumption that workers are paid their marginal product. Hellerstein et al. have independent measures of productivity and wages to test whether higher wages correspond to higher productivity. The data come from the Worker Establishment Characteristics Database (WECD), which matches the long-form responses of the 1990 Decennial Census to the data on their employers in the Longitudinal Research Database (LRD). In addition, the researchers have demographic information on workers in a sample of plants with information on plant-level inputs and outputs. The plant-level data provide the measures of productivity by demographic group, which can be compared to wages paid to those demographic groups according to the Census. They found that the higher wages paid to prime-aged workers (aged 35 to 54) and older workers (aged 55+) are justified by their higher relative marginal product. However, the lower relative earnings of women are not reflected in lower relative marginal products.

Leonard (1987) provides another test of the shirking vs. turnover versions of efficiency wage, and finds little empirical support for either. The shirking version emphasizes a trade-off between self-supervision and external supervision, whereas the turnover version assumes turnover is costly to the firm. Comparing across firms, variation in wages paid to a selected set of homogeneous workers should be explained by variations in the cost of monitoring/shirking or turnover. Even for narrowly defined occupations within one industrial sector of one state, Leonard found widely dispersed wages. This finding indicates there are more factors or a more complex process in wage determination than the relatively simple efficiency wage models.

One of the complicating factors may be the business cycle, which affects industries differently as they respond with adjustments in output, investment, and labor demand. Glosser and Golden (2005) looked at fluctuations in labor demand across U.S. manufacturing firms. They found that after 1979 hours have become more flexible and employment considerably less flexible, especially during expansion phases. To reduce turnover costs, firms are keeping a stable workforce and adjusting output by adjusting the

hours of the workers. On the one hand, more stable employment may help workers, but the demand risk has been transferred to workers in the form of fluctuating incomes. One explanation for the higher wages of risky industries is the increased uncertainty about the number of hours paid. Multiple workers per household and even multiple jobs per worker can offset the risk from uncertain hours. Cities facilitate these multiple employment arrangements. The urban population is more productive, and the households receive a higher income.

An alternative view is that labor market pooling improves the job-worker match. Costa and Kahn (2001) write about "Power Couples" in which both people have college degrees or advanced degrees and want to have fulfilling careers. The competing demands for specialized employment, lengths and costs of commutes, and quality of housing can only be satisfied in a large city. Costa and Kahn estimate that 36 percent of the increase in concentration of power couples in large cities is due to the dual career hypothesis. If the highly educated are critical to productivity gains, large cities will benefit from attracting these power couples. Pingle (2006) adds that couples' migration propensity is substantially lower when the income of the couples is more nearly equal. Once each worker in the couple has a good job, the couple is less likely to move because it is difficult to find two good job matches at the same time and place.

Smoluk and Andrews (2005) follow the tradition of estimating a wage equation loosely derived from a constant elasticity of substitution (CES) production function. The novelty is to estimate the equations at the state aggregate level and then make comparisons across the lower 48 states to determine which factors are most important to long-term economic prosperity. They found that education and density are positively related to productivity, and taxes are negatively related to productivity.

Research Ideas and Extensions

Smoluk and Andrews (2005) have made a first step in adding the spatial dimension to productivity by looking at the state level. A logical extension would be to look at the MSA or county level where most land use decisions are made. Then measures of land use regulations could be incorporated into the wage equations. A major obstacle is how to deal with the endogeneity that higher wages may cause as well as be caused by restrictive land use regulations that make housing relatively scarce. Panel data may help by using

predetermined or lagged measures of land use. Following Krueger and Summers (1988), variation by industry may also be helpful in that industries with increasing productivity are better able to compete for labor with higher wages. Cities with elastic housing supply may be able to draw more workers and grow faster with a smaller increase in wages than highly regulated cities with inelastic housing supply. A test of this hypothesis is to look across cities at the highly productive industries and compare the wage and employment responses. The opportunities for expansion may depend on the relative productivity of the other industries in the city (drawing workers away from other firms) and the restrictiveness on housing (drawing workers in from other cities). Industries with close forward and backward trade linkages within the city may benefit from generally higher productivity. Additionally, industries not tightly integrated with local suppliers may benefit from productivity gains that make it easy for the productive industry to draw workers away from other firms.

An extension of the Glosser and Golden (2005) analysis would be to investigate whether reduced employment flexibility is related to housing supply inflexibility and/or the ownership trap. Workers may not be willing to risk leaving their house because purchasing another one is so much more expensive or house values have fallen and the owners are reluctant to sell at a loss. This reluctance to move by the employee may give the employer more leverage to cut back hours without increasing turnover. According to this hypothesis, inflexible housing supply facilitates fluctuating labor demand and maybe encourages multiple worker households to diversify their income sources.

Turnover

After an opening anecdote about labor turnover at Sam's Club vs. Costco, this section presents the factors related to labor turnover. The section also reviews some of the papers on job creation, job destruction, and job flows, ending with some suggestions on follow-up research.

Wal-Mart's Sam's Club and Costco target a similar consumer market, but have a very different approach when it comes to employee wages and benefits. According to Cascio (2006), Costco has 338 stores and 67,600 full-time employees, while Sam's Club has 551 stores and 110,200 employees. Wages and benefits are much higher at Costco than Sam's Club, but Costco offsets those higher labor costs with very low turnover. The average annual cost of replacing the employees at Sam's Club is nearly three times greater than for

Costco. Here is one example where higher wages buy employee loyalty and lower turnover costs.

One of the stylized facts established by Farber (1999) is that low-skilled workers experience more job turnover than others, though that rate of turnover declines with age and length of tenure at a job. Low-skilled workers are also more likely to experience layoffs or involuntary discharges rather than to quit. And those terminations are more likely to result in a gap in employment rather than a direct movement into another job, as is more common among skilled workers.

More recently Farber (2005) analyzed the job loss experience using the Displaced Worker Survey, covering the period 1981-2003. The Displaced Worker Survey is the most comprehensive source on the incidence and costs of job loss. Since 1984, the survey has been administered every two years as a supplement to the Current Population Survey. Several issues are worth noting relative to the Displaced Worker Survey. The survey does not capture multiple job losses or termination for cause. Follow-up surveys occur after three years. Farber reports that 35 percent of the job losers are not employed as of the subsequent survey date, and about 13 percent are re-employed at part-time jobs. Of those job losers re-employed at full-time jobs, their income averages 13 percent less on the new job, and counting foregone earnings increases enjoyed by the job non-losers, the average loss is 17 percent. Even though the economy may benefit from these adjustments, job losers suffer significantly in terms of income, health benefits, pension benefits, and self esteem. There are also negative ramifications for the community with substantial numbers of long-term unemployed in terms of reduced consumer spending, loss of house value, foreclosures, and out-migration.

Although generally more common among unskilled workers, certain skilled workers, such as programmers and software engineers, experience rapid turnover. Fallick, Fleischman, and Rebitzer (2005) write about “Job Hopping in the Silicon Valley,” and report that computer industry workers have higher job mobility rates in Silicon Valley than outside of California. If thick labor markets in cities allow for better matches, then we might expect lower turnover in industrial clusters or large cities. Apparently the opportunities for better matches may offset the quality of the original match, such that labor turnover is not significantly different in large cities. Also, industry-specific shocks and rapid technological development may lead to

higher turnover despite good firm-specific matches. Specialization, which enhanced the productivity initially, may be displaced by new technology and exacerbate unemployment.

Metropolitan areas are sometimes segregated by race, which leads employers to be concerned about diversity and isolation when mixing workers across race, gender, and age. Leonard and Levine (2006) report on a large case study of 70,000 workers conducted in 1996-98 from over 800 similar workplaces owned by a single corporation. The focus is on the turnover of new hires, who are mostly young and of whom 50 percent quit within four months. Lateness or absence is the most common cause for worker dismissal. Although women disliked gender diversity, the authors find no consistent evidence that diversity increased turnover. Also (p. 566), although whites are almost twice as likely as blacks (14 vs. 7.6 percent) to live in the same Zip code as their workplace, proximity to workplace had no effect on turnover rates. Moreover, retention rates were higher for minorities when they worked in neighborhoods with many residents of their race.

More broadly, Holzer (1996) reports that average annual turnover rates across manufacturing, retail, and service sectors are approximately 21 percent or about 3 percent per month. Here turnover counts quits and discharges, but not layoffs. Stewart (2002) uses the sequence of March CPS data from 1975-2001 to investigate trends in job stability and job security. He reports that employment-to-unemployment transitions declined dramatically, representing an increase in job security. For men the improvement occurred largely in the 1990s, whereas for women the improvement spread throughout the entire timeframe. There was an equally dramatic increase in the employment-to-employment transitions (defined as job changes with two weeks or less of unemployment between jobs). For individual workers, the reduction in employment losses was paired with a reduction in stability – more job switching. The same pattern holds for married couples. The loss in stability would have been smaller if not for an increase in the proportion of couples for which the wife contributed a significant share toward the total family earnings. Two-earner families can handle job changing and are less vulnerable to job loss. The increase in female labor force participation has a powerful impact on productivity, but complicates the household decision on housing location.

Shen (2001) focuses on Boston in 1990 and reports that about 95 percent of all job openings are related to turnover. The ramification of this fact is that most job openings come from existing jobs and relatively little from job growth. The spatial distribution of job

openings follows the location of existing jobs. Thus, even though the new jobs may be occurring in suburban employment centers, which may be higher paying jobs, the geographic shift away from the central business district takes a long time.

There is a literature related to turnover that examines job creation, job destruction, and job flows. Acs, Armington, and Robb (1999) use the Longitudinal Establishment and Enterprise Microdata (LEEM) to measure the annual job flows for both manufacturing and non-manufacturing. This research, under contract for the Small Business Administration, finds that gross job flow rates decrease with firm age and establishment size (controlling for age) whether the size is measured by the initial size or the average size over a period. However, the relationship of net job growth to business size is very sensitive to the choice of average size vs. initial size of the business.

Quintin and Stevens (2005) analyze French turnover data. They find that among the surviving establishments, worker turnover is positively correlated to industry-level exit rates even after controlling for employee tenure and establishment size. This empirical finding is consistent with turnover models featuring firm-specific human capital because workers are more likely to develop firm-specific human capital if the firm survival is above average relative to the industry.

Davis, Haltiwanger, and Schuh (1996) wrote the book on *Job Creation and Destruction*, which has been updated in Davis, Faberman, and Haltiwanger (2006). For any single business, the net employment change (hires less separations) equals the job flows (creation less destruction). When aggregated over employers for a region or industry, there are typically large values for both job creation and job destruction. The new data source is the Job Openings and Labor Turnover Survey (JOLTS), which is a monthly survey of 16,000 establishments beginning in December 2000. However, JOLTS does not capture establishment entry and exit. An alternative is the Business Employment Dynamics (BED) data, which cover quarterly job flows for virtually all businesses.

Another new combination of data is the Longitudinal Employer-Household Dynamics (LEHD), which is an innovative program within the U.S. Census Bureau. State administrative (primarily unemployment insurance) data on employers and employees are combined with federal economic and demographic data while protecting the confidentiality of firms and workers. The Bureau of Labor Statistics coordinates with the states to develop consistent coding standards covering 98 percent of all private, non-agricultural employment

with quarterly earnings reports. It is possible to reconstruct complete employee rosters at a point in time and then follow the changes for the firm over time or follow the worker between employers over time. Demographic data on the workers are linked by the Census Bureau according to date of birth, place of birth, and sex of worker. Information on the firm from the Economic Censuses (taken every 5 years) and the Annual Survey of Manufactures or Business Expenditures Survey (for non-manufacturing) is linked to the unemployment insurance records. Wage equations can also be estimated that exploit the longitudinal nature of the data by controlling for worker and firm fixed effects.

Based on the LEHD data for the private sector, average job creation and destruction approaches 8 percent of employment per quarter. The worker flows in the form of hires and separations are more than twice as large. Most (two-thirds) of the job destruction occurs at establishments that shrink by more than 10 percent in the quarter, and more than 20 percent occurs at establishments that close. The research describes cyclical movements in the layoffs-separation ratio. The contribution of job-loss and job-finding rates to the unemployment rate depends on whether the employment downturn is shallow or deep. Over the long run, the magnitude of job flows and private sector job creation has been declining. A second trend has been that industries vary greatly in their reliance on layoffs for "right-sizing" employment. The new data set, with its match between Bureau of Labor Statistics data and Census Bureau data has the potential to tease out the spatial dimensions of these job flows.

Research Ideas and Extensions

A basic research question is: Do high housing costs or shortages in available housing affect the rate of labor turnover? The new matched BLS-Census data could be used to compare turnover rates by place and time. Turnover at a firm will be influenced by many factors from the industry and local economy, including the availability of housing. One hypothesis is that high housing costs lead to long commutes and higher turnover rates as workers change jobs to fit scarce housing. An alternative view is that scarce housing has a lock-in effect whereby workers are reluctant to move, so workers are willing to accept lower turnover and lower wages to keep their living unit. The net impact on productivity may depend on the added stress from long commutes, the quality of the job match, and the depth of capital and technology. Ultimately the firm and urban area face competition from other urban areas

such that job creation will shift toward those areas most successful in providing a good match to workers' needs and the capacity for additional growth.

Another hypothesis, following Shen's work, is that unskilled workers are more sensitive to job openings and skilled workers are more sensitive to job growth.

Education and Training

One way to raise the productivity and wages of workers is to increase their education or training. The Department of Labor has funded a number of training programs for disadvantaged workers. Heckman, Lalonde, and Smith (1999) review some of those programs and they find fairly limited cost effectiveness. More recent work (Heckman and Smith, 2004) decomposes the participation process for a typical training program to show that personal choices and awareness of eligibility can substantially affect the participation rates and ultimate effectiveness of the program.

An alternative to general training programs is on-the-job training or work-first approaches, which are often tied to the relative returns of job-staying and job-leaving. Holzer (2004) and Andersson, Holzer, and Lane (2005) provide an in-depth analysis of advancement for workers in the low-wage labor market using LEHD data for five states: California, Florida, Illinois, Maryland, and North Carolina. They found that (p.12), "Working in a higher-wage industry (such as manufacturing, construction, and wholesale trade), working in a larger firm, and working in a firm with low turnover are all associated with better pay for initial low earners; working for a firm that pays positive wage premia is especially important." The workers who were able to transition early to better jobs at higher-paying employers and then build up tenure at that employer did the best in the long run. Although there is great variation among firms even at the local level, the firms that provide opportunities for advancement of workers do so persistently. Training programs are most successful when they match workers to firms, which provide those workers further opportunities for advancement. Newly developed data tools by Census, such as On the Map and the Quarterly Workforce Indicators (QWI) from the LEHD program can help to identify which types of employers are hiring which types of workers in a local area. See Lane et al. (2006) for the relationship between workforce development and rental housing policy.

Public school quality is a more fundamental way to provide skills for future workers and one which is related to house prices. Brasington and Haurin (2006) use a hedonic house price model and a median voter model to estimate the income and price elasticities of demand for educational quality. They estimate the own price elasticity of demand for schooling is about –0.5 and the income elasticity of demand is about 0.5. Using cross-price elasticities, the researchers find that a community's income level, percentage of white households, and level of public safety are estimated to be substitutes for higher school quality. Not surprisingly, high-income communities provide better schools and a safer environment in which students can acquire skills needed for good jobs. The challenge is for firms in low-income communities to support the school system so that graduates have the skills needed for firm advancement. The issue of business support for local education systems parallels the issue of business support for workforce housing. Businesses benefit indirectly by getting more productive workers.

Research Ideas and Extensions

There are a number of research questions that build on the data and work already done:

- Does the lack of affordable rental housing have a differential impact on labor turnover and search relative to owner-occupied housing?
- Are employers more likely to provide training and internal advancement when high housing costs make it difficult to recruit replacement workers?
- Are firms moving to the suburbs because suburban school systems do a better job of preparing workers with the skills the firms need?

Returns to Skill, Creative Occupations, and Knowledge Spillovers

This section is divided into two subsections: firm level returns to skill and city level benefits from skilled workers. The traditional labor literature provides examples whereby firms seek out skilled workers because the firm's output and profitability is closely linked to the ingenuity of workers with specific skills. Since 2000, there have been a number of papers that show cities also benefit from skilled workers. Cities with high shares of college-educated workers tend to grow faster and offer more opportunities for advancement to other workers through knowledge spillovers. However, cities catering to the creative occupations may also be associated with higher income inequality and higher housing costs, especially when there are housing supply restrictions such as land use regulations.

Firm Level Returns to Skill

Juhn, Murphy, and Pierce (1993) documented the increase in wage inequality for U.S. workers using March Current Population Survey (CPS) data from 1963 to 1989. Wages for unskilled workers at the 10th percentile of the wage distribution declined by 5 percent, while wages for skilled workers at the 90th percentile increased by 40 percent. The researchers found that much of the increase in wage inequality was not due to schooling and years of experience and they attribute the increased inequality to other, unmeasured, skill differences. Apparently increases in demand for high-skilled workers drove up their wages.

These findings on wage inequality have led to the study of technology's role. Skilled workers can increase their productivity with advanced technology, particularly computer technology. Abowd et al. (2005) look at the relationship between technology and a variety of skill levels using LEHD data. Labor demand is derived from the production function by way of a cost minimization for a given output y_{jt} for firm j and time t:

$$S_{bjt} = \alpha_0 + \sum_k \alpha_{1k} Z_{kjt} + \sum_l \alpha_{2l} \ln(w_{ljt} / w_{Hjt}) + \alpha_3 \ln y_{jt} + \varepsilon_{jt}$$

where S_{bjt} is the share of type b workers, b=1,...,B, and w_{bjt} is the appropriate shadow wage rate for type b workers, and Z measures different types of information technology capital. The researchers have developed new measures of human capital by which they can index the composition of firms' workforces. Firm data reported in the Economic Census on inputs and outputs allow the separate identification of the technology component and multiple skill levels. The purpose is to understand how differences in technology affect the demand for different skill levels. One major finding is that firms that use a high degree of technology also use high ability workers, but are less likely to use high experience workers. As stated on page 25: "...the capital intensity of a business, the computer investment of a business, and the computer software expenditure intensity of a business are all positively related to the level of human capital at the business. ...businesses that upgrade their technology are also observed to upgrade their skills."

There appears to be great potential for this research with LEHD data because the locations of the firms are known. The local land mix and skill composition of the employees can be

merged into a panel of data. With these data a number of interesting research questions potentially could be answered:

Is there a connection between the high-technology firms, demand for high-skilled workers, high wages, high housing prices and restrictive land use regulation?

Are the housing location choices of high-skilled workers with low experience different from the choices of high-skilled workers with long experience?

Do firms that use high technology and moderately-skilled workers pay a wage premium because the technology increases the productivity of those workers?

Is that high-technology wage premium sufficient to offset the higher housing costs in the city?

Where do firms locate that use high tech to complement unskilled labor as opposed to using high technology to substitute for unskilled labor?

Another recent example of the interaction between technology and productivity is the work by Jorgenson, Ho, and Stiroh (2006). They predict labor productivity growth for the U.S. economy at 2.25 percent for the next decade based primarily on (p. 8): "The continued strength of the technological progress and the rising importance of investment in IT equipment and software imply higher trend productivity growth rates." However, there is a countervailing force from the aging of the labor force, which slows the gains from education and experience. The average labor productivity (ALP) can be decomposed into three sources: capital deepening (capital services per hour worked), labor quality (labor input per hour worked), and total factor productivity growth (associated with improvements in technology among other possibilities). The researchers classify workers by sex, employment class, age and education, then weight the hours supplied for each labor type by their labor compensation. The labor quality growth is measured as the difference between the growth rate of the compensation-weighted index of labor input and the index of hours worked. Despite the impending retirement of the baby boom generation, the researchers predict that technology-enhanced labor will continue to improve labor productivity.

City Level Benefits from Skilled Workers

Glaeser and Mare (2001) estimate that workers in cities earn on average 33 percent more than non-urban workers. Some of that premium reflects a selection effect whereby highly skilled workers are attracted to the city. However, Glaeser and Mare provide evidence that

cities make workers more productive and that a portion of the urban wage premium is paid in higher wage growth. In fact, workers who leave the city carry with them a wage premium, but the workers who remain in the city enjoy higher wage growth. Evidence from Census, NLSY, and PSID confirm that older urban workers have a larger wage premium than young workers with 0 to 5 years of experience. Peri (2002) provides additional evidence from the 1990 Census that urban workers enjoy a $2 wage premium over rural workers. Peri suggests that highly educated workers are attracted to cities where they benefit from learning externalities and gradually acquire a larger experience premium.

Recent work by Berry and Glaeser (2005) shows that college-educated urban workers get a wage premium because their efforts drive city growth. In their model (p. 1), "the clustering of skilled people in metropolitan areas is driven by the tendency of skilled entrepreneurs to innovate in ways that employ other skilled people." In the 1970s, cities grew by adding unskilled workers. But in the 1990s (p. 8), "skilled cities grew by attracting skilled workers." As the demand for skilled labor increases, wages to skilled workers increase. Moreover, wage-driven demand and regulation-constrained supply lead to increases in house prices. The net effect for unskilled workers is that they are facing higher housing prices in order to live near skilled people in the cities.

Drennan (2005) provides further evidence at the city level that wage divergence is linked to the share of college-educated workers. However, Gabe (2006) claims that an initial strong presence in the creative economy is not a prerequisite for future growth. Shapiro (2006) uses Census data from 1940 to 1990 to estimate a neoclassical growth model. He finds that a 10 percent increase in the concentration of college-educated residents is associated with a 0.8 percent increase in subsequent employment growth. The model (a dynamic variation on the Roback 1982 model) also shows that about 60 percent of the employment growth effect of college graduates is due to higher productivity growth. The rest of the employment growth is associated with improvements in the quality of life. Endogeneity is an econometric challenge throughout the urban growth literature. Shapiro addresses the issue by using the presence of a land grant university as an instrumental variable for the share of college graduates. Also, the 1989 Wharton data on land use constraints are used in a subsample as a robustness test. The productivity component remains the same (0.63), but the effect of human capital operates through employment in low-regulation areas, whereas the human capital seems to increase wages and rents in high-regulation areas. The key point is that not all of the job growth can be attributed to the higher productivity from better human

capital. A significant portion of the job growth derives from consumption amenities. Shapiro writes (p. 3), "Though preliminary, this exercise suggests the effect may be operating through the expansion of consumer amenities such as bars and restaurants (Glaeser, Kolko, and Saiz, 2001) rather than through the political process." One implication is that housing prices are increasing through a combination of higher demand (driven by population, wages, and desire for amenities) as well as supply constraints (land use regulation designed to restrict housing development).

Another dynamic model of the determinants of employment growth is provided by Owyang, Piger, Wall, and Wheeler (2006). They use a Markov-switching model to separate a city's growth path into a recession phase and an expansion phase. Growth during expansions is related to human capital, industry mix, and average firm size, whereas growth during recessions is related to industry mix, especially the relative importance of manufacturing. The frequency of recession appears to be associated with only the non-education measure of human capital. Wheeler's previous work (2005) verified that metropolitan areas have higher returns to skill and greater income inequality. Wheeler and La Jeunesse (2006) introduce the spatial effect by showing that the degree of productivity or knowledge spillover from skilled to unskilled workers depends on how the college graduates are distributed over the metropolitan area. Using a number of segregation metrics, they show that there has been an increase in separation from 1980 to 2000, which seems to be associated with more income inequality during that time.

Knowledge Spillovers

One common explanation for the urban wage premium is the idea that there are human capital externalities or knowledge spillovers that make urban workers more productive. The challenge is to separate out the aggregate effects of human capital from the private returns to education and experience. Lucas (1988) provides estimates that each year of schooling is associated with an 8 to 12 percent increase in earnings. See also Card (1999). In other words, are there social returns to education above and beyond the individual returns such that other workers in the local geographic area benefit from higher productivity and wages? Moretti (2004a) presents a unified equilibrium framework with productivity spillovers. Externalities are identified by comparing the wages of workers in cities with different levels of human capital controlling for individual worker characteristics. Alternatively, externalities

can be identified by comparing house prices across cities controlling for individual house characteristics.

Both endogeneity and unobserved heterogeneity complicate such econometric estimations. The selection process is ongoing. Both firms and workers are selecting locations based on expectations of high productivity and externalities. Workers are seeking high wages and amenities. Firms are seeking high productivity and suitable infrastructure. The alignment between firms and workers makes it difficult to determine whether the spillovers from education caused productivity and agglomeration effects or high wages make possible high education, strong institutions, and more efficient government. Moretti cites Rauch (1993) in which Census data is used to show a strong correlation between average wages and the percent of college graduates, but those estimates are presumed biased by sorting on unobserved factors. Moretti (2004b) improves on the Rauch approach by using two instrumental variables: age structure of the city and presence of a land grant college in the city. Unobserved individual ability is handled by using panels of the National Longitudinal Survey of Youth (NLSY). The instrumental variable estimates show that a one percent increase in the share of college graduates in a city raises the average wages by 0.6 to 1.2 percent beyond the private return on education. Complementarity estimates of education groups show that the least educated workers (high school dropouts) benefit more than high school graduates from the presence of college graduates.

The spillover effects estimated by Moretti are larger than what Acemoglu, Daron, and Angrist (2000) found. They used the state variation in compulsory schooling laws to instrument for average schooling. The education externality was about 1 percent, but it was not statistically significant. Moretti claims that his higher and significant estimates are attributed to focusing on college graduates at the city level, rather than high school dropouts at the state level. The theory states that less-educated workers should benefit from increased wages due to both the substitution and spillover effects. Ciccone and Peri (2002) follow a constant-composition approach. When the estimates constrain college graduates to be perfect substitutes with less-educated workers, the externality estimates are in line with Moretti and Rauch. However, when imperfect substitution is allowed, the human capital spillovers become insignificant.

As an aside, the same challenge of separating substitution from spillover effects exists for house prices. Some of the increased demand for low-cost housing may be due to an

increased demand for unskilled workers who complement skill workers. Alternatively, substitution of land uses away from low-cost housing to high-cost housing to meet the demands of skilled workers may also drive up house prices.

For a broad literature review of innovations, spillovers and agglomeration effects, see Feldman (1999). A prolific branch of the spillover literature focuses on patent citations started by Jaffe, Trajtenberg, and Henderson (1993). They found that citations to domestic patents are more likely to come from papers in the same state and SMSA. The localization effects fade slowly over time and there is no evidence that more 'basic' inventions diffuse at a different rate than others. Breschi and Lissoni (2006) claim that spatial distance is a proxy for social distance. Workers' switching between firms or social networks increases the sharing of knowledge and the pace of learning in a city. Carlino, Chatterjee, and Hunt (2005) attribute the higher patent density in a city to the fact that workers can be more selective in their job matches and therefore more productive in dense cities. Many more citations about density and agglomeration effects will be presented in the next section.

Research Ideas and Extensions

The labor market literature has provided an active research in the returns to skills and knowledge spillovers. The logical extensions would relate those findings to the spatial distribution of workers at their firms and of workers in their residences.

Is the degree of knowledge spillover affected by residential proximity or only employment proximity?

Do cities with stringent regulations favor professional services and a high share of college-educated workers?

Is the income inequality (based on residences) greater in high cost cities?

Does the high cost of housing create a barrier for unskilled workers and firms needing to employ unskilled workers?

Do land use regulations exacerbate the income inequality and segregation by income, which undercuts the spillover benefits for unskilled workers?

Is it possible to distinguish the substitution effect from spillover effect, and from land use regulation effect?

The last bullet refers to the idea that less-educated workers should benefit from higher demand (substitution effect) as firms react to high wages of skilled workers and take advantage of spillover effect (unskilled more productive by working with the skilled workers and benefiting from their innovations). It is conceivable that the higher house prices driven by increased demand for skilled workers are completely offset by the productivity and wage gains of unskilled workers such that unskilled workers are better off (despite the increase in wage dispersion and increase in housing costs). However, it seems more likely that unskilled workers would be worse off because increases in housing costs exceed their increases in employment and wages.

Chapter Five: Spatial Mismatch and Job Search

The NY Times (McGeehan, 1/26/2007) announced, “Building Boom May Mean Jobs Can’t Be All Filled, Report Says.” The construction boom in New York City was creating difficulty finding enough workers to fill the 275,000 positions in the building industry. Mr. Anderson, president of the New York Building Congress, said that contrary to conventional wisdom the typical construction worker is not a white suburbanite who commutes, but “a younger city resident who is almost as likely to have been born abroad as in America.” The boom has bolstered strong city finances, but the rapid development of expensive housing has created an affordable housing crisis driving out municipal workers and middle-class families. This chapter focuses on the differences in distribution between employment and residences that spawn frequent relocation and migration.

The interface between the labor and housing markets is most apparent when considering where workers choose to live relative to their employment, where they look for new jobs, and where they choose to migrate when commuting is no longer feasible. In essence, this chapter is about three topics: spatial mismatch, job search and migration. The spatial mismatch literature grew out of John Kain’s (1968) work pointing out that employment opportunities were primarily in the suburbs, which were a long way from minority households living in the center cities. Although the research has broadened to consider the metropolitan distributions of employment and housing, there continue to be large spatial gaps that require a car for workers to get to many suburban jobs.

The second section addresses job search and worker displacement. A key finding is that high-skilled workers search over a broader geographical area (often nationally), while low-skilled workers confine their search within the local commuting sphere. As a result, high-skilled workers move more and are unemployed less than locally bound workers. Mobility interacts with homeownership in that high-skilled workers are more likely to be homeowners. Moving costs reduce the job search effort, and it seems to diminish the search effectiveness of low-skilled workers more than high-skilled workers.

Migration entails many of the same trade-offs as commuting but on a grander scale. The traditional economic view is that firms relocate to take advantage of relative wage differentials. Both firms and workers are expected to keep moving until they reach an equilibrium in wages controlling for the cost of living. Another perspective is that firms

relocate to service growing population demands, and amenities compensate for regional differences. Regional convergence literature has given way to models justifying regional divergence. Given the endogenous relationship between migration and firm relocation, it may not be possible to resolve this chicken-and-egg relationship, but it is clear that high housing prices can counteract the in-migration to a strong labor market. And, expected housing gains and expected wage growth can offset high levels of house prices, feeding an upward spiral in house prices. Census reports that people are moving away from areas of high-cost housing and slow growth, which almost certainly ties in with land use restrictions that slow the development of workforce housing. And, circling back to the spatial mismatch concerns, most new jobs seem to be captured by in-migrants rather than local residents.

Spatial Mismatch

John Kain was instrumental in launching the spatial mismatch literature (1968) as well as providing a comprehensive review of its development twenty-four years later (1992). The issue began with a focus on housing market discrimination, i.e. segregation in housing that kept minorities from relocating in the suburbs where jobs were plentiful. The high unemployment of young black men in the center cities was associated with spatial mismatch. The young black men living in center city ghettos did not have access to housing, transportation, or the connections that would make it possible to get a higher-wage job in suburban businesses. The solutions proposed by Kain and others entailed:

1. integration of housing to allow minorities full access to suburban housing;
2. job training and placement with suburban employers;
3. wage subsidies to encourage employment of long-term unemployed persons; and,
4. integration and improvement in public schooling.

Briggs (2005) provides an update on the discrimination and segregation issues.

The modeling of spatial mismatch has been updated by Brueckner, Thisse, and Zenou (2002) who link the skill space of workers with the physical space of firms and cities. In their model the local labor market is an oligopsony in which firms compete for heterogeneous workers and firms have some market power over the workers who live in their vicinity. The degree of monopsony power exerted by firms depends on the labor supply elasticity in the

firms' labor pool area. High costs in acquiring skills and commuting to work are associated with an inelastic supply of labor. Workers bear the training cost that brings their innate skills in line with the firm's needs. Low-skilled workers are assumed to commute the greatest distance because their low wages correlate with a low value of time and toleration of a long commute. The authors conclude that socioeconomic ghettos develop because workers with low skill matches also incur the highest commuting costs.

Morrison (2005) also emphasizes the importance of heterogeneous labor in synthesizing the conflicting views on localized sub-markets with varying unemployment rates. In one model, labor demand is confined to labor sub-markets within the metropolitan market. High unemployment in those pockets is due to a shortage of jobs within a short commuting distance of workers living there. The solution is to increase labor demand by attracting private businesses or government offices into those local labor markets. A second model views the entire city as a single market for labor and capital. Localized unemployment is due to housing market clustering by income. Low-cost housing is associated with low-income families and high unemployment. In this view, spurring labor demand might increase overall output of the city, but the high-wage jobs will mostly go to people commuting from high-income neighborhoods. The long-run effect is that unemployment remains high in the low-income neighborhoods. Morrison claims that both models are relevant, but for different types of workers. Skilled, high-income workers serve the entire metropolitan market, whereas unskilled, low-income workers limit their job search to local labor sub-markets. If demand is slack in a worker's own neighborhood but tight in another neighborhood, the unskilled worker will not be able to commute to the opening as readily as the skilled worker.

As a case in point, Bruce Katz (2007) testified that the District of Columbia accounts for 34 percent of the region's high-wage jobs (paying over $75,000 per year), but only 20 percent of the low-wage jobs (paying under $35,000 per year). Low wage jobs are twice as dispersed as high-wage jobs.

Concerns about the decline in demand for unskilled workers during the 1980s (Freeman, 1991) were somewhat ameliorated during the protracted expansion of the 1990s (Freeman and Rodgers, 1999). Based on the 2000 Census, Raphael and Stoll (2002) report that during the 1990s the spatial mismatch for blacks improved by 13 percent. The correlation remains that metropolitan areas with a high degree of segregation also had a high degree of

spatial mismatch. The residential movement of blacks toward the suburbs and suburban jobs helped reduce the spatial mismatch. Martin (2004) used the decennial Census results for 1970 to 2000 and determined that both the jobs and housing distributions were gradually suburbanizing. Ironically, residents tended to move away from areas gaining jobs. Employers moved to the suburbs to be closer to the growing population centers, but that enabled many suburban workers to locate even farther from downtown. The net effect is that jobs are following the general population and blacks are following the suburban jobs. This pattern lowers the commuting times for whites, but it raises the commuting times and distances for blacks.

Using the American Community Survey (ACS 2005) and the 2000 Census, Berube and Kneebone (2006) report on another trend in America's 100 largest metropolitan areas. By 2005, poverty in the suburbs exceeded poverty in the cities by 1 million. However, poverty rates were twice as high in the cities as the suburbs (18.8 vs. 9.4 percent) and poverty rate increases were predominantly in the Midwest and South. The manufacturing cities of Cleveland, Toledo, Detroit, and Columbus were hit hardest, and those cities have some of the most affordable housing in the country. The annual ACS data make it possible to track changes in spatial mismatch for large cities, which continue to expand even when growth in the core of the city has stalled.

Vermeulen and Ommeren (2004) have calculated from Dutch data that house prices are 10.4 percentage points lower and rents are 2.4 percentage points lower when regional unemployment is one percent point higher. Their conclusion is that workers are compensated by cheaper housing in high unemployment areas and therefore don't have enough incentive to move to where more jobs are available.

Some research has called into question earlier attempts to "solve" the spatial mismatch problem. It seemed clear enough to California planners in the 1990s that there should be a balance between jobs and housing. Counties that favored businesses for their high tax revenues and low burdens on municipal services forced their neighbors to supply housing for workers. However, Cervero (1996) examined the San Francisco area and found little association between the jobs-housing balance and self-containment to reduce commuting. Even in balanced towns, there was a high degree of crisscross commuting as workers sought out the best match for their skills.

A spatial analysis of job openings in Boston by Shen (2001) showed that job openings suitable for less-educated job seekers are relatively concentrated in the center city. Most openings are from turnover rather than the creation of new positions. For jobs requiring few skills or limited experience, there was actually an advantage to living in the city where more openings occurred. However, the most important aspect in determining access to employment was access to a car. Suburban jobs are very difficult to reach by transit. Where a person lived is less important than whether the person could use a car to reach potential employers.

Finally, Bayer and Ross (2006) have determined that the net effect of neighborhood quality on labor market outcomes is actually small. A fundamental challenge in labor market studies is separating the neighborhood sorting from the individual skills. The researchers have devised a very clever instrumental variable strategy. They instrument for observed neighborhood attributes of an individual with the average neighborhood attributes of observationally equivalent individuals. This approach eliminates the portion of the variation in neighborhood attributes that is due to sorting on unobserved individual attributes and produces unbiased estimates of the neighborhood impact on employment and wages. This strategy seems well suited for other spatial studies where endogeneity is common.

Research Ideas and Extensions

The main concern in spatial mismatch is that workers may have more difficulty in obtaining employment at good wages because they live so far from work. The concerns of workforce housing are similar in that the lack of housing at a reasonable cost and distance from work will make it difficult for workers to find employment and firms to find sufficient workers. The logical extension of the spatial mismatch literature is to determine whether land use restrictions have played a role in increasing commutes or weakening the matching process between workers and firms. For example, in cities where stringent land use has reduced the availability of moderate-cost housing:

Do workers have longer commutes?
Are there sub-markets of high unemployment and low wages?
Do workers without cars have lower wages controlling for age and education?
Are minority workers living in the center city less likely to have jobs with suburban employers than minority workers living at an equal distance in the suburbs?

Do unskilled workers have longer commutes because there is not moderate-cost housing close to their employer, or shorter commutes because they only take jobs close to their home?

Do land use restrictions exacerbate racial or income segregation, which, in turn, increases the problems of spatial mismatch for workers and firms?

Job Search

There is a vast literature in labor economics on job searching and wage determination including many recent developments in game theory and strategic bilateral bargaining. Covering these topics is beyond the scope of this review, but fortunately Mortensen and Pissarides (1999) have written a comprehensive review in the Handbook of Labor Economics, Vol 3b. We focus on more recent articles that consider the role of the housing market and homeownership. In addition, there are several interesting articles on worker displacement from plant closings, which force the worker to search for an alternative job within local commuting or migrate to a new city.

Thomas Dohmen (2000) provides a theoretical model designed to fit a number of empirical regularities that he sees:

- Gross flows in migration are much larger than indicated by net migration flows.
- Most of the rise in unemployment is due to long-term unemployment rather than higher inflow rate.
- Rates of homeownership are positively correlated with unemployment suggesting that impediments to mobility play a crucial role in unemployment.
- Moving costs are higher for owners, but mobility increases with income.
- The Beveridge Curve has shifted outward meaning the number of unemployed has increased relative to each vacant position.
- Skilled workers are unemployed less often and for shorter durations than unskilled workers.
- Skilled workers move more, search more, and have a preference for search while still employed (Pissarides and Wadsworth, 1994).

Dohmen cites work by McCormick (1997) that finds little evidence that manual laborers move to low unemployment markets as predicted by the neoclassical labor model.

Moreover, Evans and McCormick (1994) provide evidence that non-manual labor is flexible and geographically integrated, while manual labor is spatially rigid. If mobility and search behavior are at least partially affected by the housing market, then the wage equation and matching models should include housing market measures. Therefore, Dohmen creates a labor market model with differing degrees of mobility based on moving costs by class of worker. The theoretical model shows that higher moving costs reduce mobility and increase unemployment. Also, indirectly the higher moving costs raise the reservation wage, which reduces job acceptance rates and prolongs unemployment. Asymmetric shocks increase the number of workers moving to the booming city and reduce the number leaving that city. Mobility increases the most for high-skilled workers with higher wages. Those skilled workers are the first to leave the depressed region and the first to take advantage of the higher wages in the booming city. As a result, skilled workers are unemployed less than unskilled workers.

One view of land use restrictions is that they increase moving costs because inelastic supply of housing is less responsive to fluctuations in demand from labor. Furthermore, zoning that restricts rental housing may disproportionately affect unskilled workers, raising their search costs and reducing their mobility, especially if the positive demand shocks for labor occur in the restricted city. The model does not address commuting issues, nor how an increase in house prices is related to moving costs, but presumably moving costs are correlated with house prices and wages.

Several recent papers have provided empirical tests for Dohmen's model. Bound et al. (2004) find that the production of college graduates in an MSA is only weakly related to the share of graduates living in the MSA. This evidence supports Dohmen's idea that skilled workers are mobile. Munch, Rosholm, and Svarer (2006) examine data for Denmark. They conclude that homeownership has a negative impact on job-to-job mobility both in terms of finding a new job in the local labor market and finding a job in a different labor market. The research also identifies a negative relationship between homeownership and unemployment risk, but a positive relationship between homeownership and wages.

McQuaid's (2006) research on job search found that professional qualifications, 'soft' verbal skills, and the willingness to send unsolicited applications to employers were significantly associated with success in job searches. McQuaid's econometric models verified that length of unemployment, age, and manual occupation in the last job could reduce re-

employment success by as much as thirty percent. High academic qualifications and the expectation of promotion raise reservation wages and hurt the chances of finding acceptable new jobs. Particularly germane, McQuaid found that geographical accessibility to local jobs was a significant and positive factor in job search success.

Wheeler (2006) drew a sample of young men from the National Longitudinal Survey of Youth (NLSY79) to study how men experiment with job changes as they establish a career. He found for the first job change that the likelihood that a worker changes industries increases with the size and diversity of his local labor market. However, on successive job changes, the association with size and diversity wanes. By the fourth change, the likelihood of changing industries actually has a negative relation to the scale and diversity of the local market. Wheeler concludes that city size and the opportunities offered by local market scale play an important role in the job matching process.

Job search is often tied to job loss and worker displacement. Hamermesh (1989) provides a good review on worker displacement facts updated by Farber (1997). Rephann, Makila, and Holm (2005) use that background to formulate a microsimulation model of the local labor market impact from an automotive plant shutdown. The model is benchmarked to households in Sweden for 1985 to 1995 with Monte Carlo simulation for stochastic transitions. The migration module allows for both intra- and interregional moves. A conditional logit model predicts the destination of the move based on measures of distance between origin-destination labor markets, and the population of working-age residents with earnings at the origin and destination labor markets. The model includes spatial, social, and economic factors, aggregated at a different geographical scale, that affects workers' location choices and employment prospects.

The microsimulation model was tested against the results of a Saab plant shutdown and accurately predicted that reemployment for older (50+) people is low, that men get reemployed more quickly than women, and that more educated and native workers have an easier time finding new jobs than other workers. Net out-migration from the region of the plant is reversed after several years as workers return (perhaps due to low house prices). Average wages decline and many workers get more education following the plant shutdown. Many laid off workers choose early retirement rather than leave their houses, though the model does not detail housing market dynamics.

An obvious extension of the model would be to incorporate a housing market so that migration decisions reflected the availability and regional cost of housing. The model assumes infinitely elastic regional labor demand, and no constraints on housing supply. The spatial detail of the microsimulation model allows land use regulations to impinge on the housing supply elasticity, which would affect migration decisions. A transportation module could also be added to predict the impact on commuting patterns and congestion. Presumably, a more extensive transportation system would allow workers to search and obtain employment in the local market. Such job replacement would avoid the cost of migration to another city, but also could reduce the worker's wage profile. The ability of a microsimulation model to accommodate spatial detail seems like an ideal platform for testing the impacts of land use restrictions in the housing market.

Regional Adjustment Models

Regional migration models can be viewed as either disequilibrium or equilibrium models. According to Carruthers and Vias (2005), the disequilibrium view of migration is that people move to areas with more jobs and higher wages. Spatial equilibrium will gradually develop when no one can improve his/her utility by moving. In this view, people follow the firms, which create the demand for workers (Greenwood, 1985). The equilibrium view of migration is that compensating differentials in wages satisfy an equilibrium condition all along. Differences in amenities, cost of living, employment security, and growth prospects compensate individuals for the difference in wages, but net of those effects people receive the same compensation at least in terms of utility. This equilibrium view corresponds to the population deconcentration view that people are dispersing to less urban locations to take advantage of reduced transportation and communication costs. Firms follow this outward dispersion in order to provide products and services to that population.

Carruthers and Vias consider these two views of migration in the context of the Rocky Mountain states. They have data for 8 states from 1982-1997 in 5-year increments. During this time the total amount of developed land in the Rocky Mountains grew by two million acres, or about half an acre per person. Low-density urbanization has emerged as the dominant mode of growth. The two-equation model estimates the log change in population density and the log change in employment density using two-stage least squares (2SLS). The data are collected from the Census of Governments, County Business Patterns, Economic Research Service, National Resources Inventory, and the Regional Economic

Information System. In their model, Carruthers and Vias hypothesize that growth has diminishing spatial effects at the development margin. Zoning predetermines the land development pattern rather than a free-market process. The authors write (p. 31), "To be clear: low-density zoning commits large tracts of open space to eventual urbanization, even if significant time passes before they are completely filled in. Zoning is well known to work against the underlying market conditions (Fischel, 1999) and has been cited as a factor that may disrupt the free-market process that adjustment models simulate." The first developed plots have a large spatial impact, which gradually tapers off as more people and firms add on. Increases in density are smaller and smaller. Lagged log of employment is used to instrument for log employment density and lagged log of population is used to instrument for log population density. In other words, the model expects and finds concurrent population density and employment density to have positive impacts on one another, but the lagged own effects will be negative as denser places realize smaller proportional changes. Thus the changes are measured in logs rather than first differences.

Carruthers and Vias conclude that what is needed is more active participation by state and local governments to preserve open space so that the existing economic development is sustainable. Environmental quality is vital to continuing economic prosperity, though it is not clear how the estimated regressions prove their point. The logic is that jobs follow people and people will stop migrating in when the natural amenities are overrun by too many people. The mathematical relationship verified by the regressions is that the first hundred people have a bigger impact on density than each succeeding hundred.

One of the underlying ideas embedded in the disequilibrium view of migration is that there are regional ripple effects as waves of migrants move between linked housing markets. Jones and Leishman (2006) test this notion on a smaller scale by studying the linkages between local housing market areas using private house sales for Strathclyde, a sub-region of Scotland. The researchers find that the extent of common price dynamics and the length of lagged response in the secondary markets depend on the rate of migration from the primary housing market to the secondary markets. Tolbert, Blanchard, and Irwin (2006) make a related point that commuting zones, rather than political boundaries, are more useful for measuring the degree of intra-urban vs. inter-urban moves.

As a final point on the impact of migration, Ottaviano and Peri (2006) determine that there is a net positive effect of cultural diversity on productivity of native workers. In cities where the

share of foreign-born residents increased between 1970 and 1990, U.S.-born citizens living in those cities experienced significant increases in wages and rents. The result holds up through various attempts to cope with omitted variable bias and endogeneity bias. It would be interesting to see what happens to these results in the cities where house prices have risen so high relative to wages that people are moving out to lower cost cities. Soureli, Pelletiere, and Wardrip (2006) find a counter-movement since 2000 of people leaving high-cost cities. Are the out-migrant households coming from the below-average wage portion of the high-cost cities? Their move could raise average wages in the cities they are leaving and increase wages and rents in the cities to which they are moving. It is necessary to separate the sorting effect of migration from the complementary effects of raising native productivity implied by Ottaviano and Peri.

Research Ideas and Extensions

Following on Dohmen's research, it would be useful to know whether the land use regulations of a city affect the job search and mobility for different classes of workers. Metropolitan areas could be ranked by degree of regulation and a mobility model could be benchmarked on the patterns in the middle third of metro areas. Then the predictions of the model could be compared to the actual patterns in the most regulated versus the least regulated to see what kinds of differences are associated with high and low degrees of regulation. Alternatively, the regulation index could be incorporated into the model to see if land use regulations have a significant impact. Our prior understanding is that regulation increases moving costs and decreases mobility, especially for less-skilled workers who have fewer choices in affordable housing. For example,

Do regulations dampen the degree to which higher-skilled workers have higher rates of mobility and lower rates of unemployment than less-skilled workers?

Do regulations increase the moving cost, frequency of moves, or distance of moves?

Is there an indirect impact of regulations through homeownership in that:

- a shortage of rental housing makes the labor force less flexible?
- high homeownership rates and high housing prices reduce the mobility of owners?

Are there differences in commuting patterns by race that are exacerbated by land use regulations (after controlling for income, education, neighborhood, car ownership, etc.)?

Do regulations affect the expectations of owners for future house price gains or the expectations of workers for wage gains?

Census data including the ACS data provide some information on the frequency and distance of moves as well as education, industry, occupation, ownership status, immigration status, and employment status of workers. It seems likely that mobility patterns are influenced by the industry and occupation of the worker, which must be controlled for to get an unbiased measure of the regulation effect. Moving cost information may be available from the Consumer Expenditure Survey or the Survey of Consumer Finances.

Chapter Six: Commuting and Transportation Networks

This chapter focuses on the challenge of workers commuting from their homes to their jobs. In most cities there is a trade-off between house prices and commuting costs. More affordable house prices at the suburban fringe are offset by longer and more expensive commutes. Relatively inexpensive car ownership and operation makes it possible for workers to live a considerable distance from their workplace. However, Rouwendal and Nijkamp (2004) point out that traditional urban economic models predicted that higher income individuals would not be willing to make long commutes. In fact, commuting cost seems to be only one factor in a household's choice of how far to live from work. Also, cheap transportation has not diminished the importance of space. The first section of the chapter examines the combined burdens of housing and transportation costs as well as the trade-off facing workers and employers as they figure out how to co-locate.

The second section considers the pay advantages from commuting. One motivation for a long commute is to obtain less expensive housing. Another motivation for extending the commute is to gain higher pay.

From an urban planner's viewpoint, a separation of employment centers from residences creates a daily challenge for the transportation network. Congested highways create barriers between bedroom communities and downtown offices. One response to the congestion is to require a balance between jobs and housing so that workers could live closer to work and reduce the amount of commuting needed. Though office parks make better neighbors than factories, requiring housing to be in the vicinity of employment centers does not guarantee that workers will lessen their commute. Even in well-balanced communities, there persists a great deal of criss-cross commuting as workers attempt to optimize their job match. Further, more compact cities may shorten commuting distances, but exacerbate the congestion as the same number of cars try to pass one another in more confined spaces.

The final section focuses on the measurement of congestion and the prospect for congestion pricing to reduce the delays during rush hours. Schrank and Lomax (2005) estimated for 85 urban areas that the annual delay for commuters stuck in traffic jams has risen from 16 hours in 1982 to 47 hours in 2003. Road pricing, time-of-day tolls, or a fuel tax have the potential of reducing congestion and promoting telecommuting, but it is less clear

how these solutions will affect worker productivity or the spatial distribution of housing. Downs (2004) points out that congestion is fundamentally a reflection of our prosperity. The more productive and higher paid the workers are, the more likely they are to will choose larger cars and larger houses in the more distant suburbs.

Trade-off Between Housing Costs and Commuting Costs

The spatial mismatch literature emphasizes that spatial separation of housing from employment makes it more difficult for workers to find and commute to good jobs, so they are more likely to be marginally employed or take lower paying, local jobs. High housing costs for units close to employment centers force workers to occupy less expensive housing, which is more distant from their jobs. Workers trade off high housing costs near work for lower-cost housing more distant from work and with higher commuting costs. In 20 of the 28 MSAs examined, Haas, Makarewicz, Benedict, Sanchez, and Dawkins (2006) find that housing affordable to moderate-income households is more distant from jobs. The researchers gathered data from the 2000 Census and the Consumer Expenditure Survey on 29,607 census tracts to measure the incomes, housing costs, transportation costs, job accessibility, and commuting characteristics of working families. The analysis was done on households that moved within the last five years. On average, working families spend 28 percent of their income on housing and 29 percent on transportation for a combined housing plus transportation cost burden of 57 percent. The combined cost burden is remarkably constant across the metropolitan areas with a low of 54 percent in Seattle to 63 percent in Chicago. Places in which housing is relatively less expensive, like Cincinnati and Detroit, are places that spend a larger share on transportation. Workers in high-cost places, like Boston and Los Angeles, spend more on housing but less on transportation. Working-class families, defined as households with income between $20,000 and $50,000, can save on housing costs by living farther away from their jobs, but the added cost of commuting generally raises their combined cost burden above 50 percent of income.

Haas et al. (2006) categorize each census tract into one of four categories according to the average share of income households spent on housing (H) and transportation (T). The percentage of households in each category is shown in parentheses:

1) Low percent on H and T: wealthy suburban community (38%)
2) Low percent on T, but high percent on H: mixed income urban community (16%)

3) High percent on H and T: lower income urban/inner-suburban community (26%)
4) Low percent on H, but high percent on T: moderate-income exurb (20%)

Commuting by auto dominates in all four quadrants, with more than 85 percent of working-class families driving to work (as summarized by Lipman, 2006). The highest share of transit use (27 percent) is in the low T/ high H quadrant, for which commuting time is an average 46 minutes compared to auto commute times of 27 minutes. In fact, the auto commute times are nearly the same (28 minutes) in the opposite quadrant of low H / high T. Transit riders, constituting 3 percent of households in this quadrant, have the longest commutes, averaging 64 minutes

In a related study using Census 2000 data by Cervero, Chapple, Landis and Wachs (2006), seven large MSAs are selected as case studies to study how working families trade off housing costs and commuting times. Researchers estimated bid-rent functions on the log housing cost per room for different household types, controlling for commute times with various interactions. Strictly speaking, commute times are jointly chosen with housing, so school test scores by PUMA are used to construct an instrument. For married-with-children households, a one-way commute of 18 to 20 minutes is associated with a housing cost premium of $500 to $570 per room per month. Other household types have flatter bid-rent curves indicating a smaller premium for a short commute.

In terms of elasticity of housing demand with respect to commute time, married households with children decreased their housing costs by 2.6 percent for each 10 percent increase in commuting time. Other household types had elasticities about half of that. Upper-income households, who have the most choice in housing locations, decrease their commute time by 8.9 percent for each 10 percent increase in income. Working families in the lowest third of the income distribution have an elasticity of 3.5 percent, which is just above homeowners at 3.2 percent. By comparison, renters, who are generally more mobile than homeowners, have an elasticity of 8.9 percent and recent movers (within last 5 years) have an elasticity of 15.1 percent. This suggests that recent movers are the most sensitive to commute times. The elasticities are expressed as a percentage decrease in housing costs relative to a 10 percent increase in commute time. People who move from a city apartment to a house in the suburbs would normally be increasing their commute times for the same job unless they switched from transit to car mode or switched to a suburban job. One interpretation of these results is that the suburbanization of jobs has facilitated a further suburbanization of

workers. Another view is that workers may be willing to pay a little more for workforce housing that is substantially closer to their job, but low-income workers and homeowners seem the least likely to move for that reason.

Cervero et al. (2006) also estimated discrete choice models in which a household's choice of commute mode is nested within or conditioned by the choice of residential neighborhood. Separate multinomial logit estimates are made for each of seven MSAs and six different household types within each MSA. The choice of neighborhood (measured by PUMA) is a function of: household income, household size, tenure, condominium, sex and age of household head, average high school test scores by PUMA, and auto accessibility to work by occupation. The choice of commute mode conditional on choice of neighborhood is a function of: auto availability, vehicles per worker, auto accessibility to work by occupation, sex and age of worker. Although referred to as choice models, the estimated probabilities reflect the availability of housing units, jobs, and transportation networks built up in previous iterations of the model as much as the preferences of workers in the current round. In other words, the short term choices are conditional on the long term patterns of infrastructure and development.

The discrete choice models show that (p.31), "Working family households consisting of married-couples with children, for example, are 86 percent less likely to live in one of Atlanta's central city PUMAs ... and 49% more likely ... to live in one of its outer suburban PUMAs than are wealthier married-couple-with-children families." Dallas-Ft. Worth and Washington, D.C. follow a similar pattern of working families living toward the outside of the city. Working families in Chicago and New York are more likely to live near secondary employment centers rather than new suburbs. Los Angeles and San Francisco are more likely to have working families living in older, center city neighborhoods.

The commuting mode choices for working families are similar to those of wealthier households because cars dominate across the board. Working families in Dallas and L.A. are more likely to carpool to work from their center city houses. Also, working families in New York are more likely to walk to work. When the neighborhood types are sorted by the ratio of transit-to-auto commute time, Chicago and New York follow the expected pattern that outer suburbs and suburban fringe communities have much longer commutes than central cities. However, for Atlanta's neighborhoods, the central city transit commute times are relatively longer and the suburban fringe has the least disparity relative to auto commute

times. So many of Atlanta's jobs are near the Perimeter Freeway that working families living downtown take twice as long to commute via transit as by car.

While it is difficult to summarize the results overall, Cervero et al. (2006) can characterize the housing burdens and commuting burdens of working-class families by MSA. For example, in Atlanta working families face high house cost burdens in fringe communities and high commuting burdens in downtown neighborhoods. In Chicago, the housing burdens are more uniform, and all working families except those living downtown face significant commuting burdens. The number of MSAs is too few to estimate patterns for the typical MSA or to reach a deeper understanding of the forces creating these patterns. The data are from a single cross-section of the 2000 Census. Extensions over time and explanatory variables could help highlight the role that land use restrictions played in shaping the residential and transportation choices made by workers.

Nelson (2004) projects workforce housing needs by household size and income bracket using the Nationwide Household Transportation Survey and then assigns the demand by occupation using the BLS report "Occupational Forecast 1998-2008." Census data provide the geographic distribution by occupation. The embedded assumption is that these distributions by income, occupation, and location will not change much during the forecast period of thirty years. Although this approach is unlikely to produce highly accurate estimates, it does convey the point that workforce housing needs are not currently being met and the disparities are likely to increase in the future.

The advantages of less time-consuming transportation connections can be measured in house prices. Sichelman (2007) reports on NAHB research showing that housing near public transit stops is higher by 12 percent. Similarly, Mikelbank (2004) shows that past, current and approved (but not yet begun) road projects have significant impacts on house values.

For our purposes, an ideal study would relate the accessibility of workforce housing to labor productivity. Prud'homme and Lee (1999) use French and Korean data to show that the elasticity of labor productivity with respect to commuting speed is +0.30. Workers with shorter commutes are somewhat more productive, which implies a city with an efficient transportation network is more productive. Cervero (2001) tests the idea of efficient urbanization on a cross-section of 47 cities from 1990 and specifically the San Francisco

Bay area. Although there appears to be some economic advantages from larger laborsheds and good accessibility between jobs and housing, Cervero concludes (p. 1668), "Statistically, the elasticities between labour productivity and both labour-marketshed size and labour accessibility were fairly small and were not highly significant." He holds out the hope that the measures might prove more significant in a model with many more MSAs. Cervero's research also supports a "peculiar" relationship between economic performance and congestion (p. 1668), "Across metropolitan areas, more crowded freeways appear to be a consequence, in part, of rapid economic growth. Accordingly, an inverse statistical relationship between average travel speeds and productivity levels was found." The author notes that during the recession of the early 1990s, the problem of traffic congestion greatly dissipated.

There appears to be back pressure such that productive cities grow and in so doing generate so much traffic that the roadways become congested. As Downs (2004) is fond of touting, congestion is a reflection of urban growth and success. The broader point may be that the availability of workforce housing must be considered in the context of the existing transportation infrastructure. Expensive worker housing, just like congested highways, may reflect economic growth and success as the urban system reaches capacity, while also signaling slower future growth as companies cannot retain or recruit more workers. Alternatively, expensive workforce housing could result from under-provision, due either to regulation frustrating new supply or to competition from higher-valued alternative building projects.

Another measure of accessibility's importance to economic outcomes is whether workers, given better access to employment, are more likely to find a job. Sanchez, Shen, and Peng (2004) analyzed data on Temporary Assistance for Needy Families (TANF) recipients in six selected MSAs. The ordered multinomial logit model regressed employment on measures of access to public transportation and employment centers. From the spatial mismatch literature, the authors expected that good access was significant in TANF recipients finding employment. However, the results showed virtually no association. The lack of recent work experience may weaken the application of this research to broader populations.

The shift from a monocentric city to a polycentric form can affect commuting and accessibility. Cervero and Wu (1998) estimate that the subcentering of employment means 23 percent more commuting as workers travel farther to get to their jobs, which are less

centrally located. Eighty percent of the additional vehicle miles are attributed to longer distances between home and work. However, the travel times are actually shorter, in part due to less traffic congestion. In another interesting study on dispersing employment using AHS data, Crane and Chatman (2003) find that a 10 percent increase in employment is associated with a 3 percent reduction in the average commuting distance. If the growth in employment occurs in the same direction as where people live, growth does not necessarily increase commuting distance.

For a number of years, commuting times remained fairly stable, and there developed the rational locator hypothesis to explain that phenomenon (Levinson and Kumar, 1994; Levinson and Wu, 2005). The idea is that a worker has a personal commuting budget and will arrange work-housing combinations that fall within an acceptable range of time. Examining Washington, D.C. data, Levinson and Wu find a stable journey-to-work time from 1957 to 1988 during a long period of suburbanization. Commuting distances and congestion increased, but average durations remained stable or declined modestly as workers shifted from slow trips downtown to faster suburban routes. However, using more recent data from 1994 and a larger geographical measure of the metropolitan area, the researchers found increasing commute times. Also, a comparison to Twin Cities data provided evidence that the spatial structure of the metropolitan area influences commuting times. Thus, Levinson and Wu reject the theory of personal commuting budget by noting that commuting times seem to change over both time and place.

Two theoretical models belong in this section on the joint determination of residential location and commuting mode choice. The first is by DeSalvo and Huq (2005), which extends the Alonso (1964) and Muth (1969) monocentric models by including mode choice and a total time budget constraint. Anas (1982, 1999) is credited with integrating a discrete and stochastic mode choice into an urban residential location model. The commuting mode is defined in terms of average speed (mode cost is linear in time), and the mode choice variable is continuous. The comparative static results show that commuters should choose higher speed modes for longer commutes, at higher wage rates, with greater tastes for housing, and with lower housing prices. Assuming housing is a normal good, workers with higher non-wage income should live farther from the CBD. The model can also show that marginal commuting cost rises with an exogenous increase in housing price. Land use regulations that lead to higher housing prices would presumably raise marginal commuting

costs, though this is not treated explicitly in the model. Some of these results become ambiguous if mode cost is allowed to be nonlinear in time.

A second theoretical model of interest is by Rouwendal (2004) on search theory and commuting choices, which incorporates spatial considerations into a standard model of job search. The model is used to develop isochrones, or acceptable commuting distances, such that the decrease in house prices is not more than offset by an increase in commuting costs. Extending the model for repeated search helps resolve the empirical finding of apparently excessive commuting. Long commutes may be followed by short commutes on the next round of searching. Both draws may be from the same distribution, which will approach a more moderate commuting distance on average after multiple draws. Also, even if the firm makes the same offer to all workers, the spatial dispersion of workers means the wage net of commuting cost varies considerably. The spatial dispersion explains the tradeoff between a higher offered wage and a longer duration of vacancy even when the workers have the same reservation wage.

Rouwendal and Nijkamp (2004) provide a critique of commuting models. The monocentric city model assumes workers do not like to commute, but not all workers can live close to their jobs clustered in the central business district. Therefore, housing prices are distributed so that closer houses are more expensive than distant ones but the difference is compensated by the distance of the commute. Increases in income or decreases in transport costs lead to greater suburbanization. Allowing for some heterogeneity in the workforce, the model predicts that high-wage workers would prefer short commutes, but the empirical evidence indicates that the rich tend to live in the suburbs.

One explanation is that the rich want new housing and less dense neighborhoods. The durability of existing housing means the land for new housing is only available on the urban fringe despite the long commute. In the long run equilibrium, suburban houses are cheaper because they are farther from work (further out on the bid-rent curve) and workers don't like to commute. But in the short run, changes in the stock may run counter to the long run equilibrium. Income sorting and exclusive zoning are other obstacles to achieving the archetypal equilibrium.

A related feature of the monocentric model is that commuting distances are minimized, although the reality often is that workers commute much longer distances than predicted.

Part of the “excess commuting” can be explained by the measurement of commuting cost in time rather than distance. Another aspect of reality is that labor and housing markets are not perfect and job matching appears much closer to random than minimizing commuting distances. Dual-earner households further complicate the residential location process of heterogeneous workers. Urban consumption amenities provide another justification for urban dwellers even when their jobs are outside of the center city.

Given these apparent empirical exceptions to the monocentric model, Rouwendal and Nijkamp point to the value of time, which Brownstone and Small (2004) estimate to be about half of the wage rate. The range of values is wide and valuations of hypothetical situations are much lower than the prices drivers do pay in actual road pricing situations. Some of the heterogeneity can be explained by differences in gender and household responsibilities. Women prefer shorter commutes and usually have primary responsibility for taking care of children outside of school. The authors remained convinced that space plays an important role in the job matching process, but commuting costs or time do not seem sufficient to explain the wide range of commuting patterns found in the empirical studies.

Commuting Impact on Pay

The prime motivation for workers to commute, especially long distances, is to increase their pay. Three studies are sufficient to make the point that workers can increase their pay by commuting to markets where employers offer higher wages. Imerman, Orazem, Sikdar, and Russell (2006) study the pay and turnover of Iowa nurses based on license information and a supplemental survey. The authors found that the exit rate from nursing is extremely small – 80 percent of nurses reach 30 years without letting their license lapse. Those that do leave nursing usually leave the workforce as well. On average, nurses commute 21 minutes to work, but rural nurses are most likely to commute more than 40 minutes. Commuting has a significant impact, raising pay by 5 percent for an additional 20 minutes of commuting. Rural hospitals and clinics have to compete with city hospitals, which offer higher wages and benefits.

Police officers in eastern Massachusetts can transfer between local police forces and keep their civil service benefits accruing. This information comes from a personal communication with a newly elected selectman from a suburban town. The towns with high-cost housing often have a difficult time keeping new recruits because the recruits establish some

experience and then transfer to a town closer to where they can afford to buy a home. High-cost towns tend to subsidize the recruiting and training for lower-cost towns. The City of Boston has a residency requirement that police officers have to live in the city to work on the city police force. Given the high cost of housing in Boston, the city must either pay higher wages or face frequent turnover and training costs to offset the drain of officers to other towns. The issue of workforce housing must be keenly felt by local police chiefs and the licensing information may provide a good approach for measuring the turnover of officers.

Another study from the Baltic countries shows how commuting has helped reduce the local disparities in wages. Hazans (2004) demonstrates that rural workers are drawn to work in the city for higher wages. The rural to urban commuting pattern reduces not only the wage differential, but also the unemployment rate differential, and increases the overall output of the economy.

One way to facilitate higher wages for low-income workers may be to subsidize their transportation. Waller (2005) counters concerns that car ownership is expensive with evidence that workers with a car are better able to obtain a job with good wages. Public transit saves money on ownership and operating cost, but the opportunity cost is that workers are more limited in their search to jobs along transit lines. Waller cites a Vermont study on subsidized car ownership by Lucas and Nicholson (2003). They found that an individual's income increased by $124 to $127 per month after obtaining a car and the individual was 19 percent more likely to have earned income. Waller concludes (p. 1), "when all costs are considered along with benefits of private vehicles, it makes sense to press for more assistance and policies that reduce car ownership costs for poor workers."

Jobs-Housing Balance

One apparent way to solve the problem of spatial mismatch and traffic congestion is to create more housing near the employment centers. According to Nowlan and Stewart (1991), Toronto managed to avoid serious traffic problems by following their office building boom in the 1970s and 1980s by accelerated downtown housing construction. However, this "solution" must overcome very substantial challenges. Businesses gain agglomeration advantages by clustering together, which motivates them to outbid residential uses for the land. Local governments enjoy the tax advantages of businesses who generally pay much more to the government than they demand in public services. And once the infrastructure

has been established for commercial purposes, it is expensive to retrofit for mixed use, especially land for schools and recreational facilities. Other obstacles include frequent job turnover, two-earner households, and exclusionary zoning policies. Cervero (1996) examined 23 San Francisco Bay area cities, and found that the jobs-housing balance worsened in 8 of the 10 most job-rich cities from 1980 to 1990. During that time, commutes increased by 30 percent even while employers and retailers were following the labor to the suburbs. In fact, 14 of the 28 Bay Area cities were more balanced in 1990 than 1980 in terms of jobs to employed residents. The exception was the wealthy communities, which blocked commercial development, and job-surplus business centers, mostly in Silicon Valley.

One city, Pleasanton, switched from a bedroom community to a jobs-surplus city during the decade after the development of a massive office park. Ironically, Pleasanton is close to balanced between jobs and housing, but far from self-contained because most workers live elsewhere and most residents work elsewhere. As Cervero explains (p. 7):

> "According to the 1990 journey-to-work statistics, 35 percent of Pleasanton's employed residents worked in San Francisco, the Silicon Valley, or the dense Oakland-Fremont corridor paralleling Interstate 880. Thus, as new jobs were created, most new workers found that Pleasanton's housing was already occupied by traditional suburban households whose workers commuted to downtown jobs. The housing units added were too few to accommodate many new workers. While Pleasanton's workforce grew from 7,161 in 1980 to 33,325 in 1990, or 365 percent, housing increased from 11,665 to 19,356 units, or only 66 percent, over that decade."

The balance would have been better, and perhaps more self-contained, if the developers of the Hacienda Business Park had been allowed to build over 2,000 apartments adjoining the office park, but a citizen backlash against growth blocked those moderate-cost residences. Fewer, high-end houses were built instead, which were too expensive for most of the clerical workers in the business park.

Cervero (1996) estimated a single-destination gravity model in which commuting time from neighboring cities to Pleasanton is a function of the number of housing units in the source city, the median single-family house price in the source city, and the straightline distance from the source city to Pleasanton. Using data from 1990 Census STF 3A, the simple log-

linear model had a goodness-of-fit (R^2) of 0.836. The long commutes can be largely explained by the availability of less expensive housing in other cities. Cervero concluded that NIMBY opposition and planning failures are at least as much to blame as market failures in providing workforce housing. Congestion tolls and parking fees can be justified as an offset to these planning failures and may force commuters to internalize the externalities generated by their commuting.

A more recent paper by Cervero (2006) continues the investigation by seeing whether the jobs-housing balance or the retail-housing mix is more important in reducing the vehicle miles traveled (VMT). Using 2000 travel-diary data from the San Francisco Bay area, the trips are divided between work trips and shopping trips, and the trips are measured in both distance and time. Cervero found that a 10 percent increase in the number of jobs within four miles of the worker's residence was associated with a 3.29 percent decrease in the vehicle miles traveled. Moreover, every 10 percent increase in the number of retail and service jobs within four miles of the worker's residence was associated with only a 1.68 percent reduction in shopping and personal-service trips. The results based on time were similar. Cervero concluded that the jobs-housing balance had a bigger role in reducing auto traffic than having retail stores close to housing.

Other studies have considered the impact of better jobs-housing balance. The Institute of Transportation Engineers (2001) Trip Generation Handbook estimated that there was a 2 percent reduction in the number of trips to work when housing is mixed with office parks, but 38 percent fewer trips when retail and housing mixed together. Ewing (1998) studied 500 communities in Florida, and found the share of people commuting within their home community was significantly higher when the number of jobs and number of housing units were approximately in balance. Krisek (2003) used longitudinal panel data from the Puget Sound area and found that shortened commutes meant fewer miles traveled, but more frequent trips. It was easier to go home and come back to work during the day when the employee lives close to work.

Levine (1998) found that low-moderate income, single worker households benefit the most from policies that promote job-housing balance, because those households are more willing to move to workforce housing projects near work. Dual earner households have more obstacles to moving. Finally, Schwanen, Dieleman, and Dijst (2004) examined Dutch data, and they found that both commuting times and distances were longer in polycentric cities,

but the metropolitan structure can only explain a small part of the commuting behavior. Given the variety of results and the prevalence of criss-cross commuting in a polycentric city, it seems safe to conclude that the jobs-housing balance is far from sufficient to reduce commuting miles and congestion, let alone self-containment.

Congestion Pricing and Measurement

Even if commute times have remained stable in some cities over extended periods, the level of congestion delays continues to worsen. Shrank and Lomax (2005) report that the annual average delay in 85 urban areas has increased from 16 hours in 1982 to 47 hours in 2003. According to the 2005 Urban Mobility Report by the Texas Transportation Institute (p. 1), "congestion caused 3.7 billion hours of travel delay and 2.3 billion gallons of wasted fuel ... to a total cost of $63 billion." The worst delays are in very large metropolitan areas. In terms of annual delay per traveler, the top three metro areas are Los Angeles, San Francisco, and Washington, D.C.

Downs (1992, 2004) boils down the traffic congestion to four causes. First, most people work during the day because it is more productive for businesses to interact that way. But the infrastructure does not and cannot have the capacity for everyone to be moving at the same time. So, some people have to wait, and in an efficient system the less productive should wait for the more productive. Second, rising incomes allow more people to own cars and move to low density suburban neighborhoods, which increases the traffic load on roads to work. Similarly, rising population combined with rising income accelerates the demand for road travel. Finally, the high volume of traffic spawned by prosperity and growth inevitably leads to traffic accidents. As we have all witnessed, even a small accident or breakdown can generate a big traffic jam when the volume of road use is high. The main point from Downs is that traffic is the result of economic success, not policy failure.

A number of researchers have tried to model the relationship between congestion and land use, particularly density and compactness. Malpezzi (1999) found that population density was negatively related to commute times, while concentration (ratio of center city population to MSA population) was positively related to commute times. Malpezzi used 1990 Census data for US MSAs and instrumented for transit supply with a predicted value of a separate transit supply equation. Ewing et al. (2003) modeled 83 MSAs in cross-section equations for both 1990 and 2000 Census data. For 2000, the authors found that the land use mix

(jobs-housing balance) was negatively related and the street accessibility mix (block length) was positively related to commute time. Gordon et al. (2004) estimated the effect of land use measures on commute times in 77 large metropolitan areas in 1990 and 2000. Their measures included demographics, and transport supply and demand, such as the proportion of commuters using transit which could be reflecting congestion delays as much as causing them. They found that suburbanization and population density reduced commute time in 2000.

The distribution of residences seems bound to affect congestion, but the actual relationship depends on the congestion measure. Sarzynski, Wolman, Galster, and Hanson (2006) have conducted a careful study of the influence of land use patterns in 1990 on the measures of traffic congestion in 2000 for a sample of 50 large U.S. urban areas. Multiple regression is used to control for prior levels of congestion, changes in an area's transportation network, and demographic features (particularly population growth). Correlation and principal components factor analyses are used to combine 14 land use indices into seven factors. The factors are scaled such that higher values indicate less sprawl. Density measures both housing units and jobs per square mile. Continuity measures the degree to which land has been developed in an unbroken fashion throughout the metropolitan area. The combination density/continuity index was found to be positively related to subsequent roadway ADT/lane (average number of vehicles per freeway lane) and delay per capita. A second finding was that housing centrality (the degree to which land use is located nearer the core of the urban area) was positively related to subsequent delay per capita. A third finding was that the housing-job proximity is inversely related to subsequent commute time. Of these measures, the first two suggest compact cities are more likely to have traffic jams, while the third shows that housing close to employment centers could reduce a worker's commute time.

Rodriguez, Targa, and Aytur (2006) study the transport implications of urban containment policies using panel data for 25 major U.S. metropolitan areas between 1982 and 1994. The measures of local containment policies are provided by Pendall (1999 and 2000) using a national survey of 1,510 cities and counties. Growth management efforts at the state level are provided by: Burby and May, 1997; Burby, Nelson, Dennis, and Handmer (2001); Carruthers, 2002; Nelson, 1999; and Zovanyi, 1998. As with the earlier research, the key problem is how to handle the endogenous relationships between land use and travel demand. The endogenous variables are density (population per land area of the

metropolitan area) and VMT (vehicle miles traveled per capita). Density is estimated on personal income, land supply, farmland value, local urban containment and state growth management. The predicted value of density is incorporated into the VMT equation along with personal income, transportation infrastructure supply, and fuel cost. An IV-2SLS model with fixed effects is estimated on the pair of equations, density and VMT. The model results show that urban containment policies increase the density of cities and increase the miles traveled, which exacerbates congestion unless there are offsetting policies such as a fuel tax or expanded public transit.

Three recent papers represent the literature on congestion pricing. Winston and Langer (2006) describe the effect of government spending on commuting costs and present the case for road pricing as the most efficient way to allocate those costs according to users' willingness-to-pay. Walls, Safirova, and Jiang (2006) consider the implications of congestion pricing on telecommuting. Based on a 2002 survey of about 5,000 Southern California residents, they found that a worker's propensity to telecommute increased with age and educational attainment as well as particulars of the job and firm, which are at least as important as the demographics. This research fits into the picture that more productive employees are less willing to commute, but it begs the question of how telecommuting propensity will affect the distribution of housing relative to employment. Certainly congestion pricing would increase the cost of commuting and increase the relative advantages of telecommuting.

The final paper addresses congestion pricing from a long run perspective of gradual changes in land use. Safirova, Houde, Lipman, Harrington, and Baglino (2006) have created a computable general equilibrium (CGE) model with a spatial component. The emphasis is on the impact of road pricing rather than land use regulation, but adapting the model for investigating regulation appears to be feasible. The CGE model is well suited for considering the social welfare aspects of land use regulation because it brings together the housing, labor, and transportation markets with the machinery for summing up the long-run welfare gains and losses. A key assumption is that markets move toward an equilibrium. The CGE model results for a cordon toll were modest long-term welfare gains on the order of 0.05 percent of annual income but it was several times larger than a short-run transportation model. The difference is due to the prediction by the CGE model that the unemployment rate would increase and employers would have to increase wages to get the needed labor supply. A second finding was that higher skilled workers benefited from the

wage increases, while the less skilled workers benefited from the toll redistribution. The magnitude of the welfare gains is sensitive to the redistribution mechanism.

Parking costs are closely connected to congestion pricing schemes as shown in the book by Arnott, Rave, and Schob (2005). They make the point that underpricing of street parking increases traffic congestion as does the cruising for parking spaces. By the authors' estimates, during peak commuting hours in large cities, 30 percent of the traffic comes from cruising for parking with an average cruise time of 7.8 minutes. A model of labor productivity considers the impact of staggered work hours. There is a trade-off between travel-time elasticity with respect to the flow-capacity ratio and the labor productivity with respect to the proportion of the workforce at work at the same time. Unfortunately, there is no empirical consensus on those elasticities, but the model does frame a fundamental issue. Workers can reduce commute times with staggered hours, but the loss in productivity through reduced agglomeration effects may hurt the economy more than it helps the workers.

Research Ideas and Extensions

The work of Haas et al. (2006) and Cervero et al. (2006) have added to the Census data a great deal of housing market, labor market, and commuting information. However, the patterns of location and the complexity of joint decision-making defy simplified representation. Certainly the monocentric model with steadily downward sloping bid-rent curves does not adequately represent real cities. Here are several ideas extending their analysis that would advance our knowledge at the local level.

1) The elasticities of house prices with respect to commuting time reported by Cervero et al. (2006) could be extended to control for age, education, occupation, or industry. It seems reasonable to expect differences by type of worker with young workers being more mobile and willing to relocate. Some occupations, such as marketing, which already entail a fair amount of travel, may be less sensitive to house location, but more sensitive to airport and freeway access. Similarly, industries may vary in their pattern of elasticities. The goal is to understand how important commuting is in the decision by workers of where to live relative to where they work. The firms and industries for which their workers are most sensitive to commuting time should be the most eager to ensure

sufficient workforce housing is available within a reasonable commuting time from their business.

2) Does the local land use regulation affect either the lengths of commutes, variation in delays, or elasticities of house prices with respect to commuting time? Zoning that makes housing supply less elastic may also be associated with workers who are less willing or able to adjust their commuting patterns to meet the fluctuating demands of businesses.
3) Commuting time and cost can influence the net wages that workers are willing to accept as well as the housing prices those workers are willing to pay. Therefore, a set of wage equations controlling for commuting times and costs could generate a set of elasticities that are as informative about workers' choices as the elasticities for house prices with respect to commuting times.
4) Labor catchment area or laborshed – Haas et al. looked at the average commuting patterns by location of residence. This approach could be extended by seeing whether restrictive zoning neighborhoods have systematically different laborsheds. The alternative view is to look at the commuting patterns by location of the firm. Where are its workers coming from? What are the turnover rates by commuting distances or times? What is the availability of affordable workforce housing within that catchment area? It may be that firms with more local workers have lower turnover and higher growth potential. Knowing the typical size of a laborshed for an industry, an economic development board could tout the number of workforce housing units available within the laborshed. A related project would be to compare growth rates of firms by the radius or average commuting time of the laborshed. Do firms that can meet their labor needs within a small laborshed have greater potential for future growth?
5) The fact that young and relatively unskilled workers seem to limit their job search to areas relatively close to their home seems to run counter to the idea that low-paid workers should be willing to commute longer distances because their value of time is lower. It may be that search areas are related to word-of-mouth networks that increase with the experience of the worker. The commuting patterns of younger workers may reflect the small search area, with wider commuting areas by age, education, experience, and frequency of search. Therefore the research approach would be to measure the commuting patterns for workers along those dimensions as a way to better understand a worker's search areas. This information could be used by firms to improve their recruiting

through targeted outreach to the areas where suitable workers live. Alternatively, firms may choose to advocate for more workforce housing close to their business so there are more workers to meet their needs.

6) The discrete version of Cervero et al. (2006) uses nested multinomial logit estimation in which the choice of commute mode is conditional on the choice of neighborhood (PUMA type). The models were estimated on the set of recent movers. A straightforward extension would be to include measures of land use restrictiveness by neighborhood to see if that influenced the choice of neighborhood. An alternative modeling approach would be to assume that there is a 3-way joint estimation of house location, work location, and commute mode. Professional workers may secure the job first then move to obtain a nice neighborhood and reasonable commute, which would justify a nested logit approach. Less skilled workers may move to a location with moderate cost housing and then begin looking for a job within commuting distance of his/her house. A two or three-way multinomial logit may be more appropriate for this group of workers.
7) Switching regression for mode choice – Another modeling alternative well suited for the choice of commute mode would be switching regression, which calculates the likelihood of a worker choosing driving his/her car or taking public transit. The car takes less time, but the worker may run into a traffic jam and have to pay for parking. The train requires a fare and more rigid schedule, but the rider can work on the train and avoid the traffic congestion. The worker considers both modes and chooses the one with less cost on average. A switching regression could use information on the revealed preference of each worker to determine the optimization rule for switching from one mode to the other.

Chapter Seven: Recommended Research Directions

Throughout the chapters there are many possible research projects. In this final chapter, we present four research directions that deserve consideration. The order does not indicate priority. Factors such as cost and plausible data sources will need to be evaluated when setting priorities for these or other projects that will form the research agenda.

1. Update and develop better measures for land use regulations that:
    a. go beyond composite index at metro level;
    b. include measures for strictness in implementation;
    c. cope with multidimensionality (time, cost, uncertainty) and collinearity;
    d. allow for differentiation at sub-metro level; and,
    e. identify data needed and most likely sources.

The existing measures of land use regulation are mostly based on the 1989 Wharton study. This study has recently been updated, but it still has the limitations of being based on information from a modest number of big city planners. It is difficult to discern from those responses the degree of regulation enforcement or the extent of fluctuation over the housing cycle. Typically a regression analysis uses a composite index at the metropolitan level because the composite index avoids the difficult issues of multidimensionality (time, cost, and uncertainty) as well as collinearity among the selected variables. The metro index also glosses over differences in land use regulation that occur by town or neighborhood within the laborshed. To acquire the necessary data, it may be necessary to collect the results of many local efforts or initiate a national survey to collect a consistent set of specific elements on a regular basis. The power of econometric analysis is clearly hampered without a panel of regulation measures. Once constructed, however, indicators of labor supply, housing market, and business activity can be related to the regulatory measures, and hypothesis testing can be conducted in a statistical framework.

2. Quantify how the diversity of regulations within a metropolitan area affects performance of the entire metropolitan area, including:
    a. gain finer resolution by industry, sub-metro geography, type of development structures and,
    b. resolve whether it is the quantity or distribution of workforce housing that matters with respect to the following:

i. house prices?
ii. labor outcomes?
iii. business growth, stability, or composition?

The impact of land use regulations in one section of a city depends greatly on the alternatives offered by nearby towns. If a wealthy neighborhood has exclusionary regulations but surrounding neighborhoods accommodate development with more permissive land use, then the net impact on business and labor markets may be insignificant. On the other hand, if competing municipalities engage in a regulatory "arms race," the housing prices could become extreme as builders have little land where the construction of moderate cost housing is permitted. Another strategically motivated pattern could be that the regulations are stringent, but the enforcement varies much more in some municipalities than others. Also, regulations may be put in place to slow development during a period of rapid growth, but eased when the demand returns to a more normal pace.

Industries vary in their reliance on workers with moderate skills, and so the impact of regulations is likely to vary by industry. Also, the agglomeration effects may develop with advances in technology such that co-location becomes relatively more important to certain industries. Municipalities willing to accommodate the growth of an industry could witness very rapid expansion that could not have been predicted five or ten years before. Such growth spurts may be more obvious when the analysis is done by municipality and industry rather than when viewed metropolitan-wide.

3. Determine how housing costs and congestion affect industries and firms including:
    a. rate of overall growth;
    b. changes in compositions by industry;
    c. differentiation by occupation, level of education, and income;
    d. identification of which industries are the winners and losers as a result of rising house prices; and,
    e. identification of which industries are winners and losers as a result of congestion (commuting cost, delay, or uncertainty).

Industries that rely heavily on mid-skill workers and have to locate downtown or in dense employment centers may be most vulnerable to high housing costs and congestion effects.

Firms locating downtown may have the benefit of better public transportation service, but much more expensive housing and parking. The goal of this research effort would be to quantify the degree to which industries vary in their sensitivity to housing costs and congestion effects. The most vulnerable industries are expected to suffer from labor shortages and limited growth. Over time those industries stagnate or shrink leading to changes in the industrial composition. Industrial and transportation companies move out of center cities being replaced by finance, insurance and high-end retail companies. Higher wages and public transportation subsidies are used to offset the rising house prices and traffic congestion. Documenting these patterns will clarify the impact that a loss of workforce housing has on the composition and location of industries in cities.

The Bureau of Labor Statistics vacancy survey (JOLTS) could be an excellent source of information to determine which industries are most affected by labor supply problems. Publication of more detailed data would be helpful. To make full use of that information, researchers would need access to the location of firms in the survey. In the past, such access has been very difficult due to confidentiality concerns. If such concerns are addressed, BLS and the Department of Labor may be willing to partner in this research.

4. Fill in qualitative detail on how rising house prices affect employers through the following:
    a. recruitment - longer search, wider search, subsidize transportation/housing, training;
    b. productivity - lateness, absenteeism, telecommuting, job shopping on the job; and,
    c. retention / turnover – shorter tenure, higher wage and promotion.

To better appreciate the connection between house prices and labor supply, we need a deeper understanding of how employers respond. The most direct response to lingering vacancies would be to increase the wages offered, but employers have many alternatives. They could intensify their recruiting with more advertising, a broader geographical search, lower standards, higher signing bonuses, subsidized relocation, etc. It would be helpful to identify the strategies used and in what circumstances they are more effective. Another dimension is to determine how labor productivity suffers when workers commute long distances or telecommute. Does flextime make the scheduling of meetings more difficult? Do workers spend more of their work-time dealing with child care issues or looking for a

replacement job? Are workers less willing to work overtime or do training sessions in the evening? Is the retention of distant workers significantly different? Do workers in high housing cost markets demand higher wages and faster promotion? A challenge throughout this research is to identify housing costs as the proximate cause of the labor supply difficulties as compared with big city competition.

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Exhibit A-1a

Full-Time and Part-Time Employees by Industry

	1955	1965	1975	1985	1995	2005
All industries	59,218	69,713	85,069	105,874	124,783	141,218
Private industries	48,036	55,598	67,069	86,079	102,707	117,090
All industries	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Private industries	81.1%	79.8%	78.8%	81.3%	82.3%	82.9%
Agriculture, forestry, fishing, and hunting	3.8%	2.5%	1.9%	1.3%	1.1%	1.0%
Mining	1.3%	0.9%	0.8%	0.8%	0.4%	0.4%
Utilities	0.8%	0.7%	0.7%	0.7%	0.5%	0.4%
Construction	4.9%	4.9%	4.4%	4.7%	4.4%	5.4%
Manufacturing	27.1%	24.6%	20.4%	17.0%	13.7%	10.1%
Durable goods	15.6%	14.5%	12.2%	10.5%	8.3%	6.4%
Nondurable goods	11.5%	10.1%	8.2%	6.5%	5.5%	3.8%
Wholesale trade	4.4%	4.5%	4.6%	4.8%	4.4%	4.1%
Retail trade	9.2%	9.8%	11.0%	11.4%	11.2%	11.2%
Transportation and warehousing	4.8%	3.8%	3.2%	2.8%	3.1%	3.1%
Information	2.6%	2.3%	2.4%	2.4%	2.3%	2.2%
Finance, insurance, real estate, rental, and leasing	3.9%	4.4%	5.0%	5.8%	5.6%	5.9%
Professional and business services	3.6%	4.6%	5.8%	8.5%	11.3%	12.3%
Management of companies and enterprises	1.1%	1.1%	1.1%	1.2%	1.2%	1.2%
Education, health care, and social assistance	3.4%	4.7%	7.1%	8.7%	11.0%	12.7%
Educational services	0.9%	1.2%	1.4%	1.5%	1.7%	2.1%
Health care and social assistance	2.5%	3.4%	5.6%	7.2%	9.3%	10.6%
Arts, recreation, accommodation, & food services	4.8%	5.2%	5.9%	7.4%	8.4%	9.2%
Other services, except government	6.5%	7.0%	5.6%	4.9%	4.8%	4.9%
Government	18.9%	20.2%	21.2%	18.7%	17.7%	17.1%
Federal	10.5%	9.2%	7.1%	6.0%	4.5%	3.6%
State and local	8.4%	11.1%	14.0%	12.7%	13.2%	13.5%
Addenda:						
Private goods-producing industries	37.1%	32.8%	27.5%	23.8%	19.7%	16.9%
Private services-producing industries	44.0%	46.9%	51.3%	57.5%	62.6%	66.0%

Source: BEA Gross Domestic Product by Industry Accounts

Table A-1b

GDP Components

	Billions of Dollars			Billions of 2000 Dollars			Price Index		
	1955	**1995**	**2005**	**1955**	**1995**	**2005**	**1955**	**1995**	**2005**
GROSS DOMESTIC PRODUCT	415	7,398	12,456	2,213	8,032	11,049	18.71	92.12	112.74
Personal consumption	259	4,976	8,742	1,386	5,434	7,841	18.68	91.58	111.49
Gross private investment	69	1,144	2,057	256	1,134	1,866	26.65	100.94	110.28
Fixed investment	64	1,113	2,036	251	1,110	1,842	25.49	100.29	110.54
Nonresidential	39	810	1,266	129	763	1,224	30.41	106.24	103.43
Structures	15	207	339	107	247	252	14.21	83.88	134.65
Equipment and software	24	603	927	55	523	985	43.17	115.22	94.13
Residential	25	303	770	155	353	608	16.17	85.77	126.71
Net exports - goods+services	1	-91	-717	.....	-71	-619	.....	.....	.....
Exports	18	812	1,303	64	778	1,196	27.67	104.38	108.95
Imports	17	904	2,020	78	849	1,815	22.00	106.41	111.27
Gov't consumption/investment	87	1,369	2,373	641	1,550	1,958	13.50	88.36	121.18
Federal	55	519	878	379	580	728	14.48	89.50	120.73
National defense	47	349	589	329	389	484	14.29	89.60	121.86
Nondefense	8	171	289	54	191	244	14.67	89.35	118.61
State and local	32	850	1,494	251	968	1,230	12.60	87.78	121.46
Goods	**205**	**2,661**	**3,887**	**662**	**2,639**	**3,881**	**30.79**	**100.86**	**100.16**
Services	**158**	**4,098**	**7,220**	**1,202**	**4,655**	**6,129**	**13.17**	**88.05**	**117.81**
Structures	**52**	**638**	**1,349**	**352**	**754**	**1,048**	**14.71**	**84.69**	**128.72**
Share of GDP:									
Personal consumption	62.4%	67.3%	70.2%	62.6%	67.7%	71.0%			
Gross private investment	16.6%	15.5%	16.5%	11.6%	14.1%	16.9%			
Fixed investment	15.4%	15.0%	16.3%	11.4%	13.8%	16.7%			
Nonresidential	9.4%	10.9%	10.2%	5.8%	9.5%	11.1%			
Structures	3.7%	2.8%	2.7%	4.8%	3.1%	2.3%			
Equipment and software	5.8%	8.1%	7.4%	2.5%	6.5%	8.9%			
Residential	6.0%	4.1%	6.2%	7.0%	4.4%	5.5%			
Net exports - goods+services	0.1%	-1.2%	-5.8%		-0.9%	-5.6%			
Exports	4.3%	11.0%	10.5%	2.9%	9.7%	10.8%			
Imports	4.1%	12.2%	16.2%	3.5%	10.6%	16.4%			
Gov't consumption/investment	20.9%	18.5%	19.0%	29.0%	19.3%	17.7%			
Federal	13.2%	7.0%	7.1%	17.1%	7.2%	6.6%			
National defense	11.3%	4.7%	4.7%	14.9%	4.8%	4.4%			
Nondefense	1.9%	2.3%	2.3%	2.4%	2.4%	2.2%			
State and local	7.6%	11.5%	12.0%	11.3%	12.1%	11.1%			
Goods	**49.3%**	**36.0%**	**31.2%**	**29.9%**	**32.9%**	**35.1%**			
Services	**38.2%**	**55.4%**	**58.0%**	**54.3%**	**58.0%**	**55.5%**			
Structures	**12.5%**	**8.6%**	**10.8%**	**15.9%**	**9.4%**	**9.5%**			

Source: BEA Release of 1/31/07

Table A-2

GDP by Industry 2005

	$Billions		Percent of Value Added				Employment		Per Full-time Equiv	
	Gross Output	Value Added	Employ Compen-sation	*Wage & Salary*	Taxes - Subs	Gross Oper. Surplus	FT+PT	Full-time Equiv	Value Added	Employee Compen-sation
Gross domestic product/All Ind	**22,857**	**12,456**	**56.5**	***45.5***	**6.9**	**36.6**	**141,218**	**126,865**	**$98,182**	**$55,465**
Private ind	**20,256**	**10,892**	**52.3**	***43.1***	**8.1**	**39.6**	**117,090**	**106,871**	**$101,919**	**$53,289**
Agriculture, forest, fishi& hunt	**312**	**123**	**34.0**	***30.2***	**-11.3**	**77.3**	**1,473**	**1,279**	**$96,247**	**$32,709**
Farms	253	96	25.3	*22.3*	-15.7	90.3	779	668	$143,500	$36,365
Forestry, fishing, & rel actvt	59	27	64.4	*58.0*	4.0	31.6	693	611	$44,586	$28,712
Mining	**396**	**233**	**21.6**	***17.4***	**8.2**	**70.2**	**564**	**557**	**$418,905**	**$90,429**
Oil & gas extraction	248	160	11.9	*9.3*	8.6	79.5	128	126	$1,266,484	$150,119
Mining, except oil & gas	64	32	48.1	*38.1*	13.4	38.6	215	212	$148,675	$71,476
Support actvt for mining	83	42	38.6	*32.6*	3.0	58.4	222	219	$192,845	$74,434
Utilities	**410**	**248**	**22.2**	***16.8***	**16.6**	**61.2**	**554**	**545**	**$455,031**	**$101,136**
Construction	**1,175**	**611**	**64.0**	***52.2***	**1.3**	**34.7**	**7,567**	**7,315**	**$83,543**	**$53,471**
Manufacturing	**4,502**	**1,513**	**61.7**	***46.6***	**3.4**	**35.0**	**14,328**	**14,044**	**$107,698**	**$66,414**
Durable goods	**2,364**	**854**	**71.7**	***54.4***	**2.1**	**26.2**	**9,003**	**8,864**	**$96,377**	**$69,103**
Wood prods	105	39	63.1	*50.8*	1.5	35.4	579	564	$69,078	$43,598
Nonmetallic mineral prods	112	53	52.3	*41.7*	2.2	45.4	508	496	$107,488	$56,264
Primary metals	194	61	52.4	*39.6*	3.5	44.1	465	459	$133,026	$69,763
Fabricated metal	271	131	62.9	*49.6*	1.6	35.5	1,525	1,504	$86,769	$54,576
Machinery	287	111	70.5	*54.8*	1.7	27.8	1,166	1,148	$96,761	$68,181
Computer & electronic	381	135	95.7	*74.7*	2.9	1.4	1,311	1,296	$104,404	$99,891
Electr equip, appliances	109	48	62.9	*43.2*	2.3	34.7	436	429	$111,476	$70,156
Motor vehicles & parts	483	95	89.8	*62.1*	2.7	7.5	1,100	1,093	$87,298	$78,425
Other transportation equip	192	71	78.1	*60.4*	1.5	20.4	673	669	$106,278	$82,999
Furniture & rel prods	85	37	74.2	*51.0*	1.0	24.9	569	556	$66,696	$49,477
Miscellaneous manf	145	73	54.2	*41.3*	1.1	44.7	670	651	$111,582	$60,447
Nondurable goods	**2,138**	**658**	**48.6**	***36.5***	**5.1**	**46.3**	**5,324**	**5,180**	**$127,069**	**$61,812**
Food, beverage & tobacco	659	176	47.1	*35.8*	11.7	41.2	1,687	1,627	$107,974	$50,819
Textile mills & textile prods	69	24	67.3	*53.0*	2.9	29.9	389	376	$63,420	$42,670
Apparel & leather	36	17	77.7	*55.9*	2.1	20.1	312	301	$55,934	$43,475
Paper prods	155	55	62.4	*45.5*	3.3	34.3	484	469	$116,330	$72,544
Printing & related	90	47	73.9	*57.5*	1.4	24.7	664	644	$72,884	$53,851
Petroleum & coal prods	398	63	20.9	*14.2*	3.1	76.1	111	109	$582,220	$121,413
Chemical prods	539	209	41.2	*29.8*	2.6	56.2	876	862	$242,734	$99,934
Plastics & rubber prods	193	68	59.5	*47.3*	2.7	37.8	802	791	$85,549	$50,942
Wholesale trade	**1,074**	**743**	**52.3**	***43.5***	**22.0**	**25.6**	**5,850**	**5,652**	**$131,492**	**$68,832**
Retail trade	**1,289**	**824**	**56.8**	***47.8***	**21.5**	**21.7**	**15,763**	**13,723**	**$60,011**	**$34,096**
Transport & warehouse	**712**	**345**	**65.2**	***51.8***	**5.4**	**29.3**	**4,379**	**4,164**	**$82,766**	**$53,990**
Air transportation	135	41	86.2	*64.8*	13.1	0.8	500	475	$86,303	$74,368
Rail transportation	58	32	54.9	*39.9*	-2.4	47.5	198	188	$171,644	$94,250
Water transportation	36	9	49.8	*39.1*	1.3	48.9	60	57	$158,474	$78,965
Truck transportation	251	114	61.1	*48.4*	2.2	36.7	1,420	1,350	$84,540	$51,683
Transit & ground pass	29	17	71.7	*58.7*	4.0	24.3	417	397	$43,116	$30,909
Pipeline transportation	39	9	42.9	*34.8*	27.4	29.7	38	36	$259,000	$111,222
Other transportation	121	89	62.5	*51.7*	9.1	28.4	1,159	1,102	$80,827	$50,517
Warehousing & storage	44	33	78.1	*64.7*	0.7	21.2	586	557	$58,704	$45,874
Information	**1,161**	**555**	**43.2**	***34.9***	**7.6**	**49.1**	**3,079**	**2,866**	**$193,724**	**$83,761**
Publishing/software	268	150	50.0	*39.6*	1.5	48.5	939	849	$176,966	$88,511
Motion picture & sound	87	41	57.8	*49.4*	2.8	39.3	382	323	$125,430	$72,542
Broadcasting & telecom	688	304	34.4	*27.6*	12.5	53.2	1,323	1,292	$235,362	$80,865
Info & data processing	118	60	61.3	*50.2*	1.6	37.1	436	401	$150,539	$92,279

Table A-2
GDP by Industry 2005

	$Billions		Percent of Value Added				Employment		Per Full-time Equiv	
	Gross Output	Value Added	Employ Compen-sation	*Wage & Salary*	Taxes - Subs	Gross Oper. Surplus	FT+PT	Full-time Equiv	Value Added	Employee Compen-sation
Gross domestic product/All Ind	**22,857**	**12,456**	**56.5**	***45.5***	**6.9**	**36.6**	**141,218**	**126,865**	**$98,182**	**$55,465**
Finance, insur, real estate	**3,991**	**2,536**	**25.2**	***21.1***	**10.4**	**64.4**	**8,308**	**7,872**	**$322,163**	**$81,330**
Finance & insurance	**1,690**	**958**	**56.2**	***46.7***	**4.5**	**39.4**	**6,101**	**5,861**	**$163,400**	**$91,796**
Credit intermediation	683	475	41.4	*34.2*	3.5	55.1	2,899	2,783	$170,576	$70,579
Securities & investments	321	167	94.6	*81.2*	2.8	2.5	822	789	$212,152	$200,801
Insurance	593	296	58.0	*47.7*	6.9	35.2	2,291	2,203	$134,425	$77,962
Funds, trusts, & other	94	19	58.7	*39.6*	4.8	36.5	89	86	$226,163	$132,698
Real estate & leasing	**2,301**	**1,578**	**6.5**	***5.5***	**13.9**	**79.6**	**2,207**	**2,011**	**$784,872**	**$50,827**
Real estate	2,053	1,473	5.1	*4.3*	14.4	80.5	1,535	1,410	$1,044,367	$52,966
Rental & leasing svcs	248	106	26.0	*22.0*	7.3	66.7	673	601	$176,073	$45,809
Professionl & business svc	**2,318**	**1,459**	**69.9**	***59.4***	**1.9**	**28.2**	**17,384**	**16,257**	**$89,732**	**$62,725**
Professional & technical	1,359	864	66.6	*56.5*	1.7	31.7	7,497	7,068	$122,257	$81,448
Legal svcs	245	181	59.4	*51.1*	3.1	37.5	1,331	1,255	$144,112	$85,578
Computer systems	180	141	83.3	*68.5*	1.8	14.9	1,201	1,132	$124,343	$103,604
Miscellaneous prof & tech	934	542	64.7	*55.1*	1.2	34.1	4,964	4,680	$115,918	$74,998
Management of enterprises	368	226	78.2	*66.0*	1.6	20.1	1,748	1,724	$130,990	$102,468
Administrative & waste mgt	591	369	72.5	*62.1*	2.5	25.0	8,139	7,465	$49,408	$35,819
Administrative & support	525	337	74.0	*63.4*	2.0	24.0	7,800	7,140	$47,136	$34,864
Waste management	66	32	57.2	*48.5*	7.6	35.2	339	325	$99,302	$56,785
Educ, health, & social asst	**1,578**	**975**	**78.5**	***66.7***	**1.2**	**20.3**	**17,932**	**16,148**	**$60,400**	**$47,439**
Educational svcs	192	116	88.7	*77.0*	1.2	10.1	2,911	2,582	$44,841	$39,770
Health care & social assist.	1,386	860	77.2	*65.3*	1.2	21.7	15,021	13,566	$63,362	$48,898
Ambulatory health care	649	442	67.7	*56.7*	0.9	31.3	5,245	4,722	$93,592	$63,394
Hospitals & res care	616	342	88.6	*75.4*	1.5	9.9	7,181	6,606	$51,801	$45,900
Social assistance	121	75	80.6	*69.8*	0.9	18.5	2,595	2,238	$33,702	$27,163
Arts, ent, rec, accom, & food	**815**	**445**	**62.3**	***53.2***	**11.6**	**26.1**	**13,008**	**10,613**	**$41,895**	**$26,080**
Arts, ent, & rec	183	114	59.3	*50.3*	10.5	30.3	1,981	1,655	$68,938	$40,853
Perf arts & rel actvt	82	54	60.2	*50.8*	7.5	32.3	500	418	$129,136	$77,677
Amusements, gambling	101	60	58.5	*49.9*	13.1	28.4	1,481	1,237	$48,597	$28,411
Accom & food svcs	**633**	**331**	**63.3**	***54.2***	**12.0**	**24.7**	**11,027**	**8,958**	**$36,899**	**$23,351**
Accommodations	171	105	53.3	*45.1*	14.8	31.9	1,837	1,684	$62,140	$33,123
Food & drink	462	226	67.9	*58.3*	10.8	21.3	9,190	7,274	$31,055	$21,089
Other svcs, except gov't	522	283	70.5	*61.5*	7.2	22.4	6,901	5,839	$48,431	$34,127
Government	**2,601**	**1,564**	**85.8**	***62.5***	**-0.9**	**15.1**	**24,128**	**19,994**	**$78,204**	**$67,099**
Federal	872	499	81.1	*52.3*	0.0	18.9	5,091	4,091	$121,927	$98,917
General government	782	437	78.7	*50.4*	0.0	21.3	4,208	3,365	$129,774	$102,074
Government enterprises	90	62	98.5	*65.8*	0.0	1.5	883	726	$85,552	$84,285
State & local	1,729	1,065	88.0	*67.3*	-1.4	13.4	19,037	15,903	$66,957	$58,914
General government	1,532	986	88.4	*67.6*	0.0	11.6	17,977	14,870	$66,322	$58,659
Government enterprises	197	79	82.2	*63.9*	-18.9	36.6	1,060	1,033	$76,099	$62,585
Private goods-producing	**6,385**	**2,480**	**57.1**	***44.4***	**2.6**	**40.3**	**23,932**	**23,195**	**$106,922**	**$61,051**
Private svcs-producing	**13,871**	**8,412**	**50.9**	***42.7***	**9.7**	**39.4**	**93,158**	**83,679**	**$100,529**	**$51,136**

Industry Employment by Occupation	Industry Annual Wage	Industry Jobs	MGT & PROF	Management	Busn & Fincl Ops	Comput & Math	Arch & Engineer	Science	Social Service	Legal	Education	Arts and Media	Health care Prof
Occupation Jobs		130,308	**36,881**	5,961	5,410	2,953	2,382	1,186	1,693	987	8,079	1,683	6,547
Occupation Annual Wage		$37,870	**$60,096**	$88,450	$57,930	$67,100	$63,910	$58,030	$37,530	$81,070	$43,450	$44,310	$59,170
113 Forestry & Logging	$31,210	65	**3.3%**	2.0%	0.7%			0.6%					
115 Sup Actvs for Ag & Forest	$20,600	304	**2.8%**	1.7%	0.4%	0.1%		0.4%			0.0%	0.1%	0.1%
211 Oil & Gas Extraction	$63,100	122	**48.1%**	11.4%	11.4%	3.4%	11.2%	8.1%		2.2%		0.1%	0.3%
212 Mining (ex Oil & Gas)	$40,130	211	**8.4%**	3.4%	1.5%	0.2%	2.0%	1.0%				0.0%	0.3%
213 Sup Actvs for Mining	$39,800	207	**13.6%**	4.9%	1.8%	1.1%	3.0%	2.1%		0.0%		0.1%	0.6%
221 Utilities	$53,720	552	**26.3%**	5.7%	6.5%	3.1%	8.5%	1.7%		0.2%	0.0%	0.4%	0.2%
236 Constr of Bldgs	$43,530	1,681	**15.1%**	8.5%	4.0%	0.2%	2.0%	0.1%		0.0%		0.3%	0.0%
237 Heavy & Civil Constr	$41,350	947	**10.6%**	5.9%	2.8%	0.1%	1.6%	0.1%		0.1%		0.0%	0.0%
238 Spcl Trade Contr	$39,930	4,587	**6.2%**	3.3%	2.3%	0.1%	0.5%	0.0%		0.0%		0.0%	0.0%
311 Food Manf	$29,200	1,479	**5.8%**	2.9%	1.3%	0.3%	0.4%	0.8%			0.0%	0.1%	0.1%
312 Bev & Tobac Manf	$38,140	191	**11.4%**	5.6%	2.2%	0.7%	0.7%	1.0%		0.0%		1.2%	0.1%
313 Textile Mills	$29,780	224	**7.3%**	3.8%	1.2%	0.4%	0.9%	0.4%				0.5%	0.1%
314 Textile Prod Mills	$27,700	173	**6.2%**	3.3%	1.0%	0.4%	0.8%	0.1%				0.8%	0.0%
315 Apparel Manf	$26,780	269	**7.2%**	3.3%	1.1%	0.4%	0.2%	0.1%				2.0%	0.0%
321 Wood Prod Manf	$29,990	558	**6.7%**	3.2%	1.5%	0.2%	1.2%	0.3%				0.1%	0.0%
322 Paper Manf	$39,340	488	**8.8%**	4.1%	2.0%		1.7%	0.3%		0.0%		0.5%	0.1%
323 Printing & Rel Actvs	$36,580	652	**11.5%**	4.1%	2.5%	1.1%	0.2%	0.2%		0.0%		3.4%	0.0%
324 Petro & Coal Prods	$51,200	113	**21.4%**	4.9%	4.9%	1.6%	6.2%	3.6%				0.1%	0.2%
325 Chemical Manf	$47,520	876	**28.9%**	7.3%	4.2%	2.0%	4.2%	10.4%		0.2%	0.0%	0.2%	0.4%
326 Plastics & Rubber Prods	$33,760	804	**9.1%**	4.2%	1.6%	0.4%	2.5%	0.2%				0.2%	0.1%
327 Nonmetal Minrl Prod	$34,660	507	**7.8%**	3.9%	1.3%	0.2%	1.6%	0.1%				0.5%	0.0%
331 Primary Metal Manf	$38,560	468	**9.8%**	3.7%	1.8%	0.5%	3.3%	0.4%				0.0%	0.1%
332 Fab Metal Prod Manf	$36,470	1,512	**11.9%**	5.0%	2.7%	0.6%	3.3%	0.2%		0.0%	0.0%	0.1%	0.1%
333 Mach Manf	$41,610	1,151	**20.4%**	6.1%	3.4%	1.6%	8.6%	0.3%		0.0%	0.0%	0.4%	0.0%
334 Comput & Elctrn	$57,570	1,313	**50.0%**	9.5%	6.5%	10.9%	20.9%	1.2%		0.1%	0.0%	0.8%	0.1%
335 Elec Eqpt & Appli	$38,650	439	**18.3%**	5.2%	2.9%	1.2%	8.1%	0.4%		0.1%	0.0%	0.4%	0.1%
336 Transpt eqpt Manf	$45,760	1,785	**22.3%**	4.1%	4.6%	2.1%	10.7%	0.3%			0.0%	0.4%	0.1%
337 Furn & Rel Prod Manf	$31,140	568	**8.1%**	3.8%	1.8%	0.5%	1.4%	0.0%		0.0%		0.5%	0.0%
339 Misc Manf	$37,630	653	**16.8%**	5.9%	3.0%	1.3%	3.6%	0.7%		0.1%	0.0%	1.7%	0.5%
423 Merch Whlslrs, Dur	$44,320	2,978	**16.6%**	6.1%	3.9%	3.9%	1.6%	0.4%	0.0%	0.0%	0.0%	0.4%	0.1%
424 Merch Whlslrs, Nondur	$39,610	2,029	**12.4%**	5.2%	3.4%	0.9%	0.2%	0.6%		0.0%	0.0%	1.4%	0.5%
425 Whlsl Elctrn Mkt	$50,280	729	**15.3%**	5.4%	4.3%	2.6%	1.4%	0.5%		0.1%	0.0%	0.9%	0.2%
441 Motor Veh& Parts Dlrs	$37,770	1,913	**6.5%**	4.6%	1.7%	0.1%	0.0%	0.0%		0.1%	0.0%	0.0%	
442 Furn & Home Furn Stores	$30,500	579	**7.1%**	3.4%	1.4%	0.2%	0.0%	0.0%				2.2%	
443 Elctrns & Appli Stores	$33,370	539	**13.2%**	3.8%	1.8%	6.0%	0.4%	0.1%			0.2%	0.9%	
444 Bldg Matl & Garden Dlrs	$28,420	1,279	**5.8%**	2.7%	1.9%	0.4%	0.1%	0.0%				0.7%	0.0%
445 Food & Bev Stores	$22,690	2,822	**4.2%**	1.9%	0.6%	0.0%						0.4%	1.3%
446 Health & Pers Stores	$32,270	948	**34.5%**	2.9%	0.7%	0.1%		0.0%				0.0%	30.8%
447 Gas Stations	$19,210	872	**1.7%**	1.4%	0.3%	0.0%		0.0%				0.0%	
448 Cloth & Cloth Acc Stores	$23,400	1,421	**3.2%**	1.9%	0.7%	0.1%	0.0%					0.4%	
451 Sport Gds, Book, & Music	$22,410	660	**5.0%**	2.5%	1.1%	0.2%		0.0%			0.6%	0.6%	

Industry Employment by Occupation	Industry Annual Wage	Industry Jobs	MGT & PROF	Management	Busn & Fincl Ops	Comput & Math	Arch & Engineer	Science	Social Service	Legal	Education	Arts and Media	Health care Prof
Occupation Jobs		130,308	**36,881**	5,961	5,410	2,953	2,382	1,186	1,693	987	8,079	1,683	6,547
Occupation Annual Wage		$37,870	**$60,096**	$88,450	$57,930	$67,100	$63,910	$58,030	$37,530	$81,070	$43,450	$44,310	$59,170
452 Gen Merch Stores	$21,720	2,977	**4.9%**	1.2%	1.0%	0.1%	0.0%	0.0%				0.7%	2.0%
453 Misc Store Retl	$24,200	923	**10.1%**	2.6%	1.1%	0.4%	0.0%	0.0%	0.0%	0.0%	0.1%	5.8%	
454 Nonstore Retl	$33,130	436	**12.9%**	4.6%	2.8%	2.3%	0.1%	0.3%		0.0%	0.0%	1.4%	1.4%
481 Air Transpt	$58,130	508	**7.0%**	2.1%	3.0%	0.9%	0.5%	0.1%		0.1%	0.0%	0.2%	0.1%
482 Rail Transpt	$52,240	213	**7.1%**	3.4%	2.3%	0.7%	0.4%	0.1%		0.1%		0.1%	0.1%
484 Truck Transpt	$36,320	1,387	**4.3%**	2.7%	1.2%	0.3%	0.1%	0.0%		0.0%		0.0%	0.0%
485 Transit & Ground Pass	$27,070	406	**2.6%**	1.6%	0.6%				0.0%			0.0%	0.3%
488 Sup Actvs for Transpt	$38,690	547	**9.6%**	4.7%	3.4%	0.6%	0.5%	0.2%		0.0%	0.1%	0.1%	0.0%
491 Postal Svc	$45,470	800	**7.2%**	4.1%	1.4%	0.4%	1.0%	0.0%		0.1%		0.1%	0.1%
492 Couriers & Mesgrs	$34,650	565	**4.9%**	2.0%	1.8%	0.5%	0.4%	0.0%		0.0%		0.0%	0.0%
493 Wrhs & Storage	$31,550	582	**5.5%**	2.9%	1.5%	0.5%	0.2%	0.1%				0.1%	0.1%
511 Pub Ind (ex Internet)	$51,070	906	**48.6%**	7.6%	4.3%	16.8%	0.3%	1.3%		0.2%	0.2%	17.9%	0.0%
512 Movie & Sound Recrd	$39,730	387	**48.6%**	4.1%	2.0%	1.3%	0.3%	0.3%	0.0%	0.1%	0.3%	40.2%	
515 Broadcst (ex Internet)	$48,010	325	**59.8%**	7.8%	2.2%	2.8%	1.4%	0.8%		0.2%	0.0%	44.5%	
517 Telecomms	$51,280	1,002	**26.9%**	4.2%	5.8%	10.3%	5.1%	0.6%		0.2%	0.0%	0.6%	0.0%
518 Internet Svc. & Data Proc	$56,770	381	**56.9%**	9.6%	7.9%	34.1%	2.4%	1.1%		0.2%	0.1%	1.3%	0.1%
522 Credit Interm & Rel Actvs	$42,470	2,843	**31.9%**	7.8%	19.8%	3.4%	0.1%	0.4%		0.3%	0.0%	0.2%	0.0%
523 Secur, Commod, & Oth	$73,460	781	**41.0%**	9.8%	21.8%	6.9%	0.1%	1.1%		0.7%	0.0%	0.5%	0.0%
524 Insur Cari & Rel Actvs	$49,020	2,130	**39.4%**	6.3%	22.2%	6.3%	0.1%	0.5%	0.1%	2.1%	0.0%	0.4%	1.3%
531 R.E.	$36,800	1,438	**19.3%**	11.5%	5.5%	0.6%	0.2%	0.3%	0.1%	0.5%	0.0%	0.4%	0.2%
532 Rental & Leasing Svcs	$29,630	645	**7.4%**	3.4%	1.6%	0.3%	0.2%	0.1%	0.0%	0.0%	0.0%	0.9%	0.8%
541 Prof, Scientific, & Tech	$58,560	6,928	**63.4%**	7.3%	11.2%	13.4%	12.0%	4.5%	0.1%	8.4%	0.3%	4.3%	2.0%
551 Mgt of Cos & Ents	$56,430	1,739	**50.9%**	16.3%	16.0%	9.0%	2.8%	1.8%	1.0%	1.0%	0.3%	1.5%	1.3%
561 Admin & Sup Svcs	$29,120	7,767	**12.6%**	2.9%	3.2%	1.7%	0.8%	0.2%	0.1%	0.3%	0.3%	0.5%	2.6%
562 Waste Mgt & Remediation	$38,610	335	**11.3%**	4.4%	2.0%	0.4%	2.6%	1.5%		0.0%	0.0%	0.1%	0.2%
611 Ed Svcs	$41,840	12,137	**73.7%**	4.4%	1.7%	1.4%	0.2%	1.2%	2.0%	0.0%	59.4%	1.5%	1.9%
621 Amb Health Care Svcs	$47,200	5,065	**44.6%**	2.6%	0.9%	0.3%	0.0%	0.7%	3.0%		0.1%	0.1%	36.8%
622 Hospitals	$43,890	5,247	**61.2%**	3.4%	1.6%	0.9%	0.1%	0.6%	2.4%	0.0%	0.5%	0.2%	51.5%
623 Nursing & Res Care	$27,190	2,840	**28.3%**	3.3%	0.8%	0.1%		0.2%	6.8%	0.0%	0.4%	0.1%	16.6%
624 Social Asst	$25,760	2,083	**48.9%**	6.1%	2.0%	0.3%	0.0%	0.4%	17.3%	0.1%	20.4%	0.5%	1.8%
711 Perf Arts, Spectator Sports	$38,190	385	**43.0%**	4.4%	4.3%	0.6%	0.1%			0.1%	1.1%	32.0%	0.4%
713 Amusement & Rec Ind	$24,670	1,339	**8.8%**	3.1%	1.0%	0.1%	0.0%	0.1%			0.6%	3.3%	0.5%
721 Accom	$23,150	1,789	**5.8%**	3.9%	1.3%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.3%	0.0%
722 Food & Drinking Places	$18,280	9,053	**2.7%**	2.4%	0.2%	0.0%		0.0%		0.0%	0.0%	0.1%	0.0%
811 Repair & Maint	$32,270	1,234	**5.2%**	2.7%	1.6%	0.5%	0.4%	0.0%			0.0%	0.0%	0.0%
812 Pers & Laundry Svcs	$24,850	1,278	**4.9%**	3.4%	0.6%	0.1%	0.0%	0.0%			0.3%	0.2%	0.3%
813 Religious, Civic, Prof Orgs	$34,980	1,300	**42.8%**	8.3%	12.2%	1.5%	0.2%	0.9%	7.5%	0.5%	5.8%	5.3%	0.5%
999 Govt (OES Designation)	$44,250	9,440	**37.1%**	5.4%	8.7%	2.2%	3.0%	3.1%	5.0%	2.8%	2.2%	0.6%	4.2%

Industry Employment by Occupation	Industry Annual Wage	Industry Jobs	Production/ Support	Health Suppt	Protective Svc	Food Prep & Rel	Bldg & Grounds	Pers Svc	Sales	Office & Admin	Farm Fish Forest	Const & Extract	Install & Maintain	Produc- tion	Transport
Occupation Jobs		130,308	**93,427**	3,364	3,057	10,798	4,343	3,189	13,930	22,784	443	6,370	5,305	10,249	9,595
Occupation Annual Wage		$37,870	**$29,111**	$23,850	$35,750	$17,840	$21,930	$22,180	$32,800	$29,710	$21,010	$38,260	$38,050	$29,890	$28,820
113 Forestry & Logging	$31,210	65			0.3%		0.6%		0.3%	7.4%	57.2%	0.6%	4.3%	5.5%	20.3%
115 Sup Actvs for Ag & Forest	$20,600	304	**97.1%**	0.1%	0.1%		1.7%	1.7%	0.8%	5.3%	70.5%	0.1%	1.8%	2.6%	12.4%
211 Oil & Gas Extraction	$63,100	122	**51.7%**				0.2%		1.0%	17.0%		11.7%	3.2%	9.6%	9.0%
212 Mining (ex Oil & Gas)	$40,130	211	**91.6%**		0.2%		0.3%		0.9%	6.5%	0.0%	35.1%	13.1%	12.1%	23.4%
213 Sup Actvs for Mining	$39,800	207	**86.1%**		0.0%	0.1%	0.3%		1.9%	8.5%		52.2%	6.0%	7.1%	10.0%
221 Utilities	$53,720	552	**73.7%**		0.6%	0.0%	0.5%		1.7%	21.6%	0.1%	6.1%	27.1%	13.7%	2.3%
236 Constr of Bldgs	$43,530	1,681	**84.9%**	0.0%	0.1%		0.9%	0.0%	2.7%	12.4%	0.0%	64.1%	2.0%	0.9%	1.7%
237 Heavy & Civil Constr	$41,350	947	**89.4%**		0.4%	0.1%	1.3%	0.1%	1.5%	8.4%	0.0%	57.9%	9.5%	1.5%	8.5%
238 Spcl Trade Contr	$39,930	4,587	**93.8%**		0.0%	0.0%	0.5%		1.8%	8.9%	0.0%	69.5%	8.2%	1.3%	3.5%
311 Food Manf	$29,200	1,479	**94.2%**	0.0%	0.1%	2.4%	1.7%	0.0%	3.8%	7.0%	1.3%	0.3%	5.8%	53.7%	18.0%
312 Bev & Tobac Manf	$38,140	191	**88.6%**		0.1%	1.5%	0.9%	0.1%	10.5%	10.1%	2.6%	0.5%	9.3%	28.0%	25.1%
313 Textile Mills	$29,780	224	**92.6%**		0.1%		0.6%		1.6%	9.3%		0.7%	8.4%	62.7%	9.3%
314 Textile Prod Mills	$27,700	173	**93.7%**		0.1%		0.5%		3.2%	11.3%		0.9%	4.2%	63.6%	9.9%
315 Apparel Manf	$26,780	269	**92.8%**		0.1%		0.6%		2.8%	12.3%		0.0%	2.0%	68.5%	6.5%
321 Wood Prod Manf	$29,990	558	**93.3%**		0.2%		0.7%		2.5%	7.0%	1.6%	7.1%	4.4%	50.7%	19.0%
322 Paper Manf	$39,340	488	**90.3%**		0.1%		0.4%		2.4%	9.3%	0.1%	1.3%	8.4%	53.8%	14.4%
323 Printing & Rel Actvs	$36,580	652	**88.5%**		0.0%		0.5%		6.2%	19.3%		0.1%	1.7%	53.4%	7.4%
324 Petro & Coal Prods	$51,200	113	**78.4%**		0.2%	0.1%	0.1%		1.8%	8.3%		6.6%	9.8%	40.6%	11.0%
325 Chemical Manf	$47,520	876	**71.1%**	0.1%	0.2%	0.0%	0.7%	0.0%	3.3%	11.2%		0.8%	7.1%	40.0%	7.7%
326 Plastics & Rubber Prods	$33,760	804	**90.9%**		0.0%		0.6%		1.9%	8.6%		0.7%	5.6%	61.1%	12.4%
327 Nonmetal Minrl Prod	$34,660	507	**92.2%**		0.1%		0.5%		3.1%	8.8%		5.9%	6.3%	39.5%	28.0%
331 Primary Metal Manf	$38,560	468	**90.2%**		0.2%		0.6%		1.5%	6.9%		2.9%	9.7%	58.6%	9.8%
332 Fab Metal Prod Manf	$36,470	1,512	**88.1%**		0.1%	0.0%	0.7%		2.3%	10.6%		2.6%	3.5%	61.4%	6.8%
333 Mach Manf	$41,610	1,151	**79.6%**		0.0%	0.0%	0.6%		3.5%	10.9%	0.0%	1.4%	4.1%	55.3%	3.7%
334 Comput & Elctrn	$57,570	1,313	**50.0%**	0.0%	0.2%	0.0%	0.4%		3.3%	10.3%		0.1%	3.0%	30.9%	1.9%
335 Elec Eqpt & Appli	$38,650	439	**81.7%**		0.1%		0.4%	0.0%	2.6%	10.2%		0.6%	4.0%	57.4%	6.5%
336 Transpt eqpt Manf	$45,760	1,785	**77.7%**		0.2%	0.0%	0.5%	0.0%	1.0%	6.3%	0.0%	3.6%	7.0%	54.0%	4.9%
337 Furn & Rel Prod Manf	$31,140	568	**91.9%**		0.1%	0.0%	0.6%		2.8%	9.7%		3.3%	1.9%	65.2%	8.4%
339 Misc Manf	$37,630	653	**83.2%**	0.1%	0.1%	0.0%	0.6%	0.0%	4.5%	14.6%		0.7%	2.6%	53.9%	6.2%
423 Merch Whlslrs, Dur	$44,320	2,978	**83.4%**	0.0%	0.1%	0.0%	0.4%	0.0%	25.2%	23.9%	0.0%	0.6%	10.5%	6.6%	16.1%
424 Merch Whlslrs, Nondur	$39,610	2,029	**87.6%**	0.1%	0.1%	0.2%	0.7%	0.0%	22.3%	23.1%	2.4%	0.1%	2.1%	5.4%	31.2%
425 Whlsl Elctrn Mkt	$50,280	729	**84.7%**		0.2%	0.1%	0.4%	0.0%	39.2%	23.3%	0.5%	0.3%	4.6%	3.9%	12.2%
441 Motor Veh& Parts Dlrs	$37,770	1,913	**93.5%**		0.1%	0.0%	0.8%	0.0%	37.7%	14.0%		0.0%	28.0%	0.8%	11.9%
442 Furn & Home Furn Stores	$30,500	579	**92.8%**		0.1%	0.2%	0.9%		52.1%	17.8%		4.4%	1.1%	3.1%	13.2%
443 Elctrns & Appli Stores	$33,370	539	**86.5%**		0.6%	0.0%			53.0%	15.1%		0.1%	12.4%	1.1%	4.2%
444 Bldg Matl & Garden Dlrs	$28,420	1,279	**94.2%**		0.3%		1.2%	0.1%	57.2%	13.3%	1.0%	2.1%	2.4%	2.0%	14.6%
445 Food & Bev Stores	$22,690	2,822	**95.8%**	0.2%	0.2%	11.6%	0.7%	0.1%	42.6%	21.4%	0.3%		0.3%	8.0%	10.5%
446 Health & Pers Stores	$32,270	948	**65.5%**	3.6%	0.1%	0.5%	0.2%	0.3%	44.4%	11.0%		0.0%	0.4%	2.6%	2.3%
447 Gas Stations	$19,210	872	**98.1%**		0.0%	9.2%	1.1%		73.8%	3.5%			4.3%		6.2%
448 Cloth & Cloth Acc Stores	$23,400	1,421	**96.8%**		0.3%	0.2%	0.3%	0.1%	84.9%	7.6%			0.2%	2.5%	0.7%
451 Sport Gds, Book, & Music	$22,410	660	**94.9%**		0.2%	1.5%	0.5%	0.5%	76.7%	9.4%			2.4%	1.3%	2.4%

Industry Employment by Occupation	Industry Annual Wage	Industry Jobs	Production/ Support	Health Suppt	Protective Svc	Food Prep & Rel	Bldg & Grounds	Pers Svc	Sales	Office & Admin	Farm Fish Forest	Const & Extract	Install & Maintain	Produc- tion	Transport
Occupation Jobs		130,308	**93,427**	3,364	3,057	10,798	4,343	3,189	13,930	22,784	443	6,370	5,305	10,249	9,595
Occupation Annual Wage		$37,870	**$29,111**	$23,850	$35,750	$17,840	$21,930	$22,180	$32,800	$29,710	$21,010	$38,260	$38,050	$29,890	$28,820
452 Gen Merch Stores	$21,720	2,977	**91.3%**		1.6%	1.4%		2.1%	56.0%	23.6%	0.0%	0.0%	1.4%		5.2%
453 Misc Store Retl	$24,200	923	**89.9%**	0.0%	0.1%	0.5%	0.7%	1.6%	61.2%	13.0%	0.2%	0.5%	3.2%	2.3%	6.6%
454 Nonstore Retl	$33,130	436	**86.9%**		0.1%	2.4%	0.4%	0.1%	16.1%	36.8%	0.1%	0.2%	8.9%	2.0%	19.8%
481 Air Transpt	$58,130	508	**92.8%**		0.2%		0.2%	22.5%	0.9%	31.6%		0.0%	11.3%	0.4%	25.7%
482 Rail Transpt	$52,240	213	**92.9%**		0.6%	0.3%	0.0%	0.5%	0.2%	8.1%		7.9%	17.7%	4.5%	52.9%
484 Truck Transpt	$36,320	1,387	**95.7%**		0.1%		0.2%	0.0%	1.6%	12.5%	0.1%	0.3%	4.9%	0.3%	75.7%
485 Transit & Ground Pass	$27,070	406	**97.0%**	0.0%	0.4%		0.3%	4.9%	0.7%	10.7%			4.4%		75.5%
488 Sup Actvs for Transpt	$38,690	547	**90.4%**		0.9%	0.2%	0.7%	1.9%	3.5%	28.7%	0.0%	0.5%	11.1%	2.1%	40.7%
491 Postal Svc	$45,470	800	**92.8%**		0.3%		2.1%		2.3%	83.4%		0.1%	2.6%	0.0%	2.1%
492 Couriers & Mesgrs	$34,650	565	**95.1%**		0.1%	0.0%	0.1%		0.9%	22.4%		0.0%	2.2%	0.0%	69.4%
493 Wrhs & Storage	$31,550	582	**94.4%**		0.6%		1.1%	0.0%	3.2%	28.0%	0.2%	0.1%	3.3%	4.8%	53.2%
511 Pub Ind (ex Internet)	$51,070	906	**51.3%**		0.1%	0.0%	0.4%		13.0%	20.2%		0.1%	0.8%	8.8%	8.0%
512 Movie & Sound Recrd	$39,730	387	**51.4%**		0.7%	11.7%	1.4%	14.4%	9.7%	9.6%		0.1%	0.5%	1.1%	2.1%
515 Broadcst (ex Internet)	$48,010	325	**40.2%**		0.1%	0.0%	0.3%	0.1%	14.0%	18.2%		0.1%	7.1%	0.1%	0.3%
517 Telecomms	$51,280	1,002	**73.0%**		0.1%		0.1%		16.7%	29.4%		0.2%	26.1%	0.1%	0.3%
518 Internet Svc, & Data Proc	$56,770	381	**43.0%**		0.1%	0.0%	0.1%		6.4%	33.1%			1.9%	1.0%	0.3%
522 Credit Interm & Rel Actvs	$42,470	2,843	**68.1%**		0.2%	0.0%	0.3%	0.0%	6.8%	60.4%		0.0%	0.2%	0.0%	0.1%
523 Secur, Commod, & Oth	$73,460	781	**58.9%**	0.0%	0.2%	0.1%	0.2%	0.0%	23.5%	34.5%	0.0%	0.1%	0.2%	0.0%	
524 Insur Cari & Rel Actvs	$49,020	2,130	**60.6%**	0.1%	0.1%	0.0%	0.2%	0.0%	15.9%	43.9%		0.0%	0.2%	0.1%	0.1%
531 R.E.	$36,800	1,438	**80.7%**	0.3%	2.3%	1.6%	11.6%	1.5%	15.9%	27.5%	0.1%	1.6%	17.2%	0.2%	1.0%
532 Rental & Leasing Svcs	$29,630	645	**92.6%**	0.2%	0.1%	0.2%	0.4%	0.3%	43.8%	13.9%	0.1%	1.0%	10.0%	1.4%	21.2%
541 Prof, Scientific, & Tech	$58,560	6,928	**36.6%**	1.0%	0.2%	0.1%	0.7%	0.4%	4.4%	25.8%	0.1%	0.8%	0.9%	1.5%	0.8%
551 Mgt of Cos & Ents	$56,430	1,739	**49.1%**	0.5%	0.7%	0.9%	1.4%	0.7%	5.9%	30.0%	0.3%	0.8%	2.3%	2.0%	3.6%
561 Admin & Sup Svcs	$29,120	7,767	**87.4%**	1.3%	8.3%	1.6%	20.6%	0.8%	6.5%	22.3%	0.4%	2.8%	2.1%	9.0%	11.7%
562 Waste Mgt & Remediation	$38,610	335	**88.7%**		0.2%		0.6%		2.5%	11.8%	0.0%	19.8%	6.4%	2.7%	44.6%
611 Ed Svcs	$41,840	12,137	**26.3%**	0.3%	0.9%	3.8%	4.5%	1.6%	0.3%	10.7%	0.0%	0.4%	1.3%	0.2%	2.5%
621 Amb Health Care Svcs	$47,200	5,065	**55.3%**	20.6%	0.1%	0.1%	0.6%	4.3%	0.3%	28.5%			0.2%	0.3%	0.4%
622 Hospitals	$43,890	5,247	**38.8%**	13.2%	0.9%	2.9%	3.7%	0.5%	0.2%	15.2%		0.3%	1.1%	0.5%	0.3%
623 Nursing & Res Care	$27,190	2,840	**71.7%**	37.3%	0.4%	10.7%	6.0%	8.5%	0.2%	5.1%	0.0%	0.0%	1.5%	1.6%	0.4%
624 Social Asst	$25,760	2,083	**51.1%**	5.6%	0.4%	2.6%	2.5%	25.4%	0.6%	9.2%	0.0%	0.1%	0.6%	1.1%	3.0%
711 Perf Arts, Spectator Sports	$38,190	385	**56.7%**	0.0%	4.1%	6.8%	4.1%	13.9%	6.8%	12.2%	1.0%	1.1%	2.4%	0.7%	3.5%
713 Amusement & Rec Ind	$24,670	1,339	**91.2%**	0.4%	4.1%	21.2%	12.3%	30.1%	8.3%	8.3%	0.1%	0.4%	4.1%	0.2%	1.7%
721 Accom	$23,150	1,789	**94.2%**	0.3%	2.1%	25.9%	29.0%	7.3%	2.9%	18.7%	0.0%	0.2%	4.4%	2.1%	1.4%
722 Food & Drinking Places	$18,280	9,053	**97.3%**	0.0%	0.3%	89.3%	0.7%	0.1%	3.3%	0.8%	0.0%	0.0%	0.1%	0.5%	2.1%
811 Repair & Maint	$32,270	1,234	**94.8%**		0.0%	0.0%	0.7%	0.0%	5.4%	11.9%	0.0%	0.9%	49.6%	8.9%	17.3%
812 Pers & Laundry Svcs	$24,850	1,278	**94.9%**	1.7%	0.2%	0.2%	3.0%	40.1%	10.3%	10.7%	0.0%	0.1%	0.9%	18.1%	9.6%
813 Religious, Civic, Prof Orgs	$34,980	1,300	**57.2%**	0.2%	3.3%	7.5%	5.2%	12.4%	2.3%	23.0%	0.1%	0.1%	2.0%	0.2%	0.8%
999 Govt (OES Designation)	$44,250	9,440	**62.9%**	1.5%	19.6%	1.1%	2.6%	2.8%	0.8%	19.1%	0.3%	5.0%	4.0%	1.9%	4.3%

Exhibit B1 Metro Location Quotients 2005		U.S. Employment Thou-sands	 *Share*	MSAs with Data	Agg MSA LQ	Range of MSA LQs Lowest	 10th %	 Median	 90th %	 Highest
Tot	**Total Incl Gov't**	131,572								
0	**Total Private**	110,611	*84.07%*	98	**1.01**	0.88	0.94	1.02	1.05	1.09
)A	**Goods-Producing**	23,184	*17.62%*	97	**0.88**	0.49	0.74	0.91	1.30	1.79
A	**Service-Providing**	87,427	*66.45%*	99	**1.05**	0.72	0.92	1.02	1.10	1.14
RM	**Natural Resource & Mining**	1,724	*1.31%*	88	**0.62**	0.05	0.13	0.34	1.50	15.34
11	**Ag/Forestry/Fishing**	1,164	*0.88%*	70	**0.58**	0.02	0.11	0.25	1.72	19.14
111	Crop prod	549	*0.42%*	87	**0.67**	0.01	0.09	0.36	2.18	14.21
112	Animal prod	212	*0.16%*	69	**0.31**	0.03	0.06	0.21	1.41	10.89
115	Ag & forestry sup actvs	322	*0.25%*	77	**0.69**	0.01	0.04	0.17	2.02	42.63
21	**Mining**	560	*0.43%*	66	**0.29**	0.03	0.07	0.20	0.88	7.46
211	Oil & gas extraction	126	*0.10%*	22	**2.64**	0.00	0.03	0.44	9.51	17.89
212	Mining ex oil & gas	211	*0.16%*	59	**0.39**	0.06	0.11	0.36	1.18	3.20
213	Sup actvs for mining	223	*0.17%*	31	**0.86**	0.00	0.02	0.15	4.98	10.31
22	Utilities	551	*0.42%*	68	**0.89**	0.23	0.45	0.88	1.37	2.55
23	**Construction**	7,269	*5.52%*	92	**1.01**	0.64	0.72	1.01	1.41	2.78
236	Constr of bldgs	1,710	*1.30%*	82	**1.00**	0.55	0.70	0.95	1.38	2.24
237	Heavy constr	931	*0.71%*	78	**0.90**	0.38	0.48	0.93	1.63	4.89
238	Spcl trade contr	4,628	*3.52%*	94	**1.06**	0.64	0.76	0.97	1.53	3.14
	Manufacturers	14,190	*10.79%*	94	**0.89**	0.22	0.51	0.87	1.44	2.01
311	Food	1,477	*1.12%*	77	**0.69**	0.03	0.29	0.67	1.69	5.14
312	Bev & tobac prod	192	*0.15%*	71	**0.93**	0.04	0.18	0.81	2.42	5.32
313	Textile mills	217	*0.16%*	55	**0.59**	0.01	0.04	0.23	1.75	15.25
314	Textile prod mills	169	*0.13%*	72	**0.68**	0.11	0.18	0.46	1.55	4.66
315	Apparel	258	*0.20%*	74	**1.06**	0.01	0.05	0.23	1.13	6.34
321	Wood prod	559	*0.42%*	80	**0.49**	0.08	0.20	0.52	1.21	2.04
322	Paper	483	*0.37%*	68	**0.87**	0.02	0.17	0.87	1.66	3.72
323	Printing & rel sup actvs	645	*0.49%*	73	**0.99**	0.10	0.44	0.82	1.53	5.21
324	Petro & coal prods	112	*0.09%*	49	**1.04**	0.05	0.13	0.51	2.79	8.76
325	Chemical manf	872	*0.66%*	78	**0.95**	0.03	0.14	0.71	2.13	5.07
326	Plastics & rubber prods	800	*0.61%*	81	**0.82**	0.08	0.27	0.79	1.69	4.16
327	Nonmetal minrl prod	504	*0.38%*	79	**0.86**	0.19	0.55	0.84	1.61	4.61
331	Primary metals	465	*0.35%*	72	**0.83**	0.00	0.15	0.48	2.11	14.94
332	Fab metal prod	1,516	*1.15%*	88	**0.94**	0.09	0.38	0.89	2.01	2.71
333	Machinery	1,158	*0.88%*	80	**0.86**	0.07	0.32	0.70	1.92	3.34
334	Comput & elctrn prod	1,308	*0.99%*	77	**1.26**	0.01	0.14	0.61	2.49	13.32
335	Electrical eqpt & appli	434	*0.33%*	72	**0.84**	0.04	0.14	0.68	1.96	4.49
336	Transpt equipment	1,770	*1.35%*	73	**0.92**	0.03	0.12	0.61	2.16	9.28
337	Furn & rel prod manf	565	*0.43%*	77	**0.80**	0.12	0.30	0.59	1.25	8.14
339	Misc manf	648	*0.49%*	80	**0.97**	0.16	0.39	0.83	1.41	5.08
	Trade Transpt & Utilities	25,658	*19.50%*	100	**1.00**	0.72	0.88	0.99	1.13	1.43
42	**Whlsl Trade**	5,753	*4.37%*	79	**1.02**	0.51	0.67	0.93	1.23	1.45
423	Merch whlslrs dur Gds	2,995	*2.28%*	89	**1.08**	0.56	0.64	0.99	1.36	1.91
424	Merch whlslrs nondur Gds	2,015	*1.53%*	86	**0.99**	0.38	0.58	0.92	1.19	1.57
425	Elctrn mkts & brokers	743	*0.56%*	76	**0.94**	0.35	0.46	0.80	1.19	2.14
	Retail Trade	15,256	*11.60%*	98	**0.97**	0.82	0.91	1.01	1.16	1.39
441	Motor veh& parts dlrs	1,914	*1.45%*	91	**0.95**	0.58	0.86	1.05	1.29	1.50
442	Furn & home furn stores	574	*0.44%*	82	**1.07**	0.58	0.76	1.05	1.33	3.11
443	Elctrns & appli stores	537	*0.41%*	81	**1.12**	0.62	0.79	1.01	1.37	2.23
444	Bldg matl & garden supply	1,276	*0.97%*	90	**0.92**	0.59	0.83	0.98	1.25	2.01
445	Food & bev stores	2,808	*2.13%*	90	**1.01**	0.64	0.76	0.99	1.43	1.56
446	Health & pers care stores	949	*0.72%*	87	**1.03**	0.57	0.78	1.00	1.28	1.50
447	Gas stations	865	*0.66%*	92	**0.70**	0.34	0.52	0.85	1.26	1.84
448	Cloth & cloth acc stores	1,418	*1.08%*	82	**1.12**	0.54	0.75	0.99	1.26	1.88
451	Sport Gds, book & music	651	*0.49%*	79	**1.05**	0.65	0.76	1.03	1.38	1.86

Exhibit B1 Metro Location Quotients 2005		U.S. Employment		MSAs with Data	Agg MSA LQ	Range of MSA LQs				
		Thou-sands	*Share*			Lowest	10th %	Median	90th %	Highest
452	Gen merch stores	2,936	*2.23%*	81	**0.92**	0.58	0.74	0.97	1.24	1.51
453	Misc store retail	903	*0.69%*	90	**1.02**	0.71	0.83	1.04	1.27	2.26
454	Nonstore retail	426	*0.32%*	84	**0.98**	0.16	0.39	0.85	1.66	5.77
	Transpt & Warehouse	4,099	*3.12%*	80	**1.06**	0.33	0.54	0.98	1.53	3.29
481	Air transpt	499	*0.38%*	65	**1.41**	0.01	0.13	0.51	2.25	4.93
484	Truck transpt	1,389	*1.06%*	83	**0.82**	0.26	0.40	0.84	1.68	2.50
485	Transit & ground pass	385	*0.29%*	79	**1.21**	0.08	0.33	0.78	2.27	4.55
488	Sup actvs for transpt	551	*0.42%*	83	**1.17**	0.24	0.41	0.86	1.95	3.64
492	Couriers & mesgrs	562	*0.43%*	75	**1.17**	0.38	0.55	0.94	1.62	6.20
493	Warehouse & storage	584	*0.44%*	75	**1.05**	0.14	0.44	0.92	1.73	5.13
51	**Information**	3,056	*2.32%*	83	**1.13**	0.41	0.58	0.88	1.36	2.08
511	Pub ind ex Internet	903	*0.69%*	79	**1.05**	0.29	0.45	0.79	1.47	4.19
512	Movie & sound recrd ind	374	*0.28%*	75	**1.34**	0.16	0.35	0.53	0.96	8.31
515	Broadcst ex Internet	326	*0.25%*	83	**1.10**	0.08	0.56	0.86	1.69	2.58
517	Telecomms	992	*0.75%*	77	**1.16**	0.27	0.61	0.94	1.63	3.13
518	ISPs & data proc	381	*0.29%*	76	**1.27**	0.06	0.18	0.81	1.80	6.17
	Financial Activities	8,038	*6.11%*	96	**1.14**	0.54	0.68	0.98	1.34	2.56
52	**Finance & Insur**	5,913	*4.49%*	90	**1.16**	0.47	0.59	0.97	1.46	3.16
522	Credit interm & rel actvs	2,871	*2.18%*	88	**1.09**	0.46	0.62	0.90	1.39	2.00
523	Secur/commod invst	794	*0.60%*	78	**1.41**	0.19	0.27	0.58	1.33	6.16
524	Insur cari & rel actvs	2,138	*1.63%*	79	**1.13**	0.37	0.51	1.03	1.69	4.99
53	**R.E., Rental, & Leasing**	2,125	*1.62%*	89	**1.13**	0.49	0.68	0.93	1.30	1.86
531	Real Estate	1,456	*1.11%*	77	**1.18**	0.39	0.62	0.91	1.37	2.00
532	Rental & leasing svcs	643	*0.49%*	48	**1.08**	0.72	0.78	1.07	1.42	1.75
	Prof & Business Svcs	16,870	*12.82%*	95	**1.14**	0.50	0.74	1.02	1.30	1.70
54	**Prof & tech**	7,055	*5.36%*	75	**1.13**	0.37	0.57	0.89	1.41	2.12
541	Prof & tech svcs	7,055	*5.36%*	75	**1.13**	0.37	0.57	0.89	1.41	2.12
55	**Management**	1,743	*1.32%*	62	**1.19**	0.06	0.44	0.93	1.77	3.21
551	Mgt of cos & ents	1,743	*1.32%*	62	**1.19**	0.06	0.44	0.93	1.77	3.21
56	Admin & waste svcs	8,071	*6.13%*	75	**1.12**	0.58	0.76	1.02	1.45	2.22
561	Admin & sup svcs	7,733	*5.88%*	80	**1.10**	0.57	0.74	1.01	1.43	2.27
562	Waste mgt & remediation	338	*0.26%*	65	**0.95**	0.34	0.54	0.92	1.39	2.01
	Education & Health Svcs	16,479	*12.53%*	97	**1.03**	0.53	0.76	0.99	1.39	1.75
61	**Education svcs**	2,144	*1.63%*	78	**1.19**	0.31	0.52	0.83	1.78	3.49
62	**Health Care & Social**	14,335	*10.90%*	81	**1.00**	0.56	0.77	1.04	1.34	1.87
621	Amb health care svcs	5,108	*3.88%*	88	**1.01**	0.72	0.84	1.00	1.28	3.30
622	Hospitals	4,301	*3.27%*	85	**1.00**	0.25	0.58	1.05	1.46	1.61
623	Nursing & res care facil	2,839	*2.16%*	72	**0.88**	0.31	0.55	0.92	1.52	2.06
624	Social asst	2,087	*1.59%*	67	**0.91**	0.55	0.64	0.87	1.40	1.96
	Leisure & Hospitality	12,739	*9.68%*	96	**1.00**	0.76	0.83	0.96	1.18	3.13
71	**Arts entrt & rec**	1,868	*1.42%*	90	**1.10**	0.41	0.67	1.01	1.32	4.19
711	Perf arts & spectator sports	380	*0.29%*	80	**1.23**	0.21	0.53	0.96	1.60	3.19
712	Museums zoos & parks	119	*0.09%*	58	**1.14**	0.07	0.28	0.86	2.51	4.25
713	Amus gambling & rec	1,370	*1.04%*	76	**1.07**	0.44	0.66	0.98	1.36	5.36
72	**Accom & food svcs**	10,871	*8.26%*	93	**0.99**	0.70	0.80	0.97	1.17	3.42
721	Accommodations	1,811	*1.38%*	86	**0.94**	0.34	0.43	0.62	1.38	14.90
722	Food & drink svcs	9,060	*6.89%*	87	**0.98**	0.74	0.87	1.01	1.16	1.35
81	**Other svcs ex public admin**	4,324	*3.29%*	92	**1.07**	0.60	0.78	0.98	1.25	1.58
811	Repair & maint	1,235	*0.94%*	84	**0.99**	0.70	0.85	1.02	1.21	1.46
812	Pers & laundry svcs	1,273	*0.97%*	81	**1.11**	0.46	0.79	1.04	1.27	1.45
813	Membership assn & orgs	1,297	*0.99%*	88	**1.04**	0.32	0.58	0.96	1.44	2.02
814	Private households	519	*0.39%*	74	**1.27**	0.14	0.23	0.40	2.29	5.20
99	**Unclassified**	262	*0.20%*	80	**0.66**	0.00	0.02	0.19	1.11	2.93