

Transit and Regional Economic Development



CTOD CENTER FOR
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DEVELOPMENT

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ABOUT THIS STUDY

“Transit and Regional Economic Development” was prepared by the Center for Transit-Oriented Development (CTOD). The CTOD is the only national nonprofit effort dedicated to providing best practices, research and tools to support market-based development in pedestrian-friendly communities near public transportation. We are a partnership of two national nonprofit organizations – Reconnecting America and the Center for Neighborhood Technology – and a research and consulting firm, Strategic Economics. Together, we work at the intersection of transportation planning, climate change, sustainability, affordability, economic development, real estate, and investment. Our goal is to help create neighborhoods where young and old, rich and poor, can live comfortably and prosper, with affordable and healthy lifestyle choices and ample access to opportunity for all.

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NOTICE

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I. INTRODUCTION AND KEY FINDINGS

In many regions throughout the country, the fastest growing employment centers are now located in auto-oriented suburban communities at the edge of metropolitan regions.¹ From a public transportation perspective, dispersed and low-density employment centers are very difficult to serve through fixed-guideway transit.² The location of new jobs at the edge also has important equity implications, as low-income residents have difficulty accessing jobs in auto-oriented suburbs from their inner city, urban, or rural neighborhoods. This can result in a significant cost to households and individuals as they spend more time and money commuting to work.³ Furthermore, there are important environmental impacts from job sprawl, including an increase in land consumption, and greater pollution and greenhouse gas emissions.

In order to promote more sustainable and equitable regions, many policy makers at the local and regional levels are working to find ways to concentrate future employment growth in higher density mixed-use districts. Transit is seen as a central mechanism for facilitating increased densities in the core, countering dispersal trends. At the same time, transit agencies are increasingly focusing efforts on providing transit corridors that serve major existing employment centers in order to promote ridership and sustain healthy operations.

A closer look at employment decentralization patterns by industry sector reveals that there are important nuances within the overall trends towards job sprawl. Research indicates that some types of firms may have a preference for higher-density urban locations, and can benefit from agglomeration. For example, a recent Brookings study showed that of all employment categories, manufacturing jobs were the most suburbanized, with 77 percent located more than five miles from city centers; by contrast, skill-intensive jobs were the least suburbanized, at 67 percent.⁴

This paper examines the composition of existing employment in areas served by fixed-guideway rail transit⁵, and explores how industries vary in their proclivity to locate in higher density, transit-served locations. It also assesses which industries have experienced recent growth near transit in absolute numbers, even though they may have a declining share of total employment in transit areas. The outcome of this analysis is a better understanding of the types of industries that may have a greater propensity to be transit-oriented. This paper is intended to provide a framework for how the coordination of regional economic development, land use and transportation planning efforts can better promote healthy, high-functioning regions.

This effort is a companion to CTOD's report, "Transit-Oriented Development and Employment" which explores the need to consider regional employment centers in planning transit systems, and discusses how destinations and workplaces can be better incorporated into the discussion of transit-oriented development (TOD). This paper builds on the findings of that document, while focusing primarily on the location decisions of employers. Specifically, this report explores the differential benefits of density near transit to various industries. This frame is used to analyze the degree to which different industry sectors are

¹ This topic is discussed in detail in CTOD's draft white paper, "TOD and Employment."

² Fixed-guideway transit includes commuter rail, light rail, trolley, streetcar, and selected bus rapid transit (BRT) corridors.

³ Ibid

⁴ Raphael, Steven and Michael Stoll, *Job Sprawl and the Suburbanization of Poverty*, the Metropolitan Policy Program at Brookings, March 2010

⁵ This data was collected using the CTOD Database of transit areas in 34 transit regions in the United States, described in more detail in Appendix B.

currently attracted to transit-rich locations and to examine the character of employment clusters that are located near transit.

The analyses of this paper engage the question of how employment patterns relate to transit. It further assesses how regional economic development and land uses policies can leverage the location preferences of specific industries in order to foster economic growth near transit, rather than in auto-dependent locations. Findings from this paper will be of interest to regional economic development planners working to build long-term structural capacity for economic growth. It will also be of interest to transit planners that seek to maximize regional employment access and achieve high levels of ridership. Policymakers and planners will be able to use this paper to identify which industries currently express the greatest affinity toward transit and, thus, may be most appropriate to target for recruitment or retention in transit-oriented locations. The findings of this paper may also be help to make more cost-effective transit investments to better serve transit-oriented businesses and their employees.

SUMMARY OF KEY FINDINGS

Although employment has been sprawling away from central business districts for the past century, jobs have not dispersed evenly, either in terms of geography or industry. Certain high-skill “knowledge-based” industries, which include Professional, Scientific and Technical services, Information, Finance, and Insurance sectors, are more likely to locate in central business districts and higher density regional employment areas.

Approximately one quarter of the jobs in the 34 transit regions studied are located near transit.⁶ In 2008, 23 percent of all employment in the transit regions was located within a half-mile of existing fixed-guideway transit stops. This accounts for more than 14 million transit accessible jobs nationwide.

System size is a critical factor driving the share of employment located near transit. The greater the number of stations in a region’s transit system, the greater the share of its jobs were accessible by transit. For example, regions with large systems had 20 percent of jobs near transit, while regions with extensive systems had 45 percent of jobs in transit locations. This finding suggests that the benefits of a transit-oriented location for businesses are strongly related to the extent of the accessibility that the system can confer.

Recent trends indicate that transit areas are growing in total employment. Station areas exhibited an overall one percent increase in absolute employment. Sectors that exhibited especially strong growth within station areas over this period were: Arts, Entertainment, and Recreation and Food and Accommodation (each grew by 14 percent); Health Care and Social Assistance (which grew by 10 percent); and (which grew by 9 percent). At the same time, there was also a 22 percent drop in manufacturing jobs within these transit zones, some of which can be attributed to the displacement of these uses to other locations, as well as the conversion of industrial lands to other higher-density residential and commercial office uses.

Some industry sectors have a greater propensity to locate near transit. The government sector has the greatest affinity for transit locations of any industry sector analyzed. In 2008, with 42 percent of all public sector jobs were located in transit zones. Firms in knowledge-based industries were also more likely to be attracted to transit-rich areas. About 36 percent of jobs in Professional, Scientific, and

⁶ These 34 regions are metropolitan areas in the U.S. with fixed-guideway transit (defined as commuter rail, light rail, trolley, streetcar, and bus rapid transit (BRT) corridors with designated lanes. The regions and transit systems are listed in Appendix B.

Technical services are located within a half mile of a transit station. Retail and Production, Distribution and Repair industries were also well-represented in transit areas.

Transit areas are generally losing the share of total regional employment in most industry sectors. Although the transit areas experienced absolute growth in jobs from 2002-2008, these station areas contained a declining share of regional employment for every industrial sector, except for Utilities, Information, and Arts, Entertainment, and Recreation. This implies that much of the metropolitan job growth is occurring in auto-oriented locations.

There appears to be a relationship between employment density and the sectoral mix found in a transit area. The sectoral mix of jobs within a station area skews to more knowledge-based firms when station areas have higher employment densities. Knowledge-based industries compose 45 percent of jobs in transit zones with very high employment density, compared to only 15 percent in very low density transit areas. Similarly, public sector employment also comprises a higher share of the industry mix in higher density station areas. Conversely, Retail and Production, Distribution, and Repair employment declines as the area's employment density increases. Most other industry groups are less sensitive to the employment density.

Employers value access to transit, and this is reflected in the growth of jobs in transit areas. The number of jobs in transit locations is growing, especially in high-skill sectors like knowledge-based industries. This suggests that there continues to be demand for infill locations, especially in downtowns and higher density employment centers. Therefore, there may be further opportunities for planners and policymakers to capitalize on this demand and work to encourage specific types of businesses to locate and expand near transit. This effort will require strong coordination between metropolitan planning organizations, regional economic development agencies, transit agencies, and local jurisdictions to enact policies that can support and encourage both existing and future employment uses in transit-rich locations.

II. AGGLOMERATION AND TRANSIT

Transit ridership and density have an inherently symbiotic relationship. Greater densities at station areas create a larger market for workers, residents, or customers that can easily access transit; similarly high transit ridership (and the usually attendant higher quality of service) creates an incentive for businesses, services, and residents to locate at greater densities near stations. While these factors are deeply related, however, each has a different set of potential benefits to industries, which may vary across sectors. The ability of policymakers to reverse trends of job sprawl and to incent concentrations of employment near transit depends in part on leveraging the natural proclivity for certain industries to agglomerate, or concentrate, at these nodes. In this section, CTOD provides a contextual understanding of the role of transit in facilitating agglomeration, and how this can contribute to regional economic development.

TRANSIT AND THE COMMUTE TRIP

Basic statistics about why riders use transit underscore the importance of focusing on the role of the workplace in designing and sustaining transit systems. According to surveys conducted from 2000 to 2005, trips between home and work constitute 59 percent of all transit trips taken nationally.⁷ In contrast, work-related trips comprise only 18 percent of all trips for the average U.S. household.

This suggests that transit systems are especially well-equipped to address the needs of commute trips. This is due to a combination of each of the three major components of the home-work transit trip: system design, location decisions of employers, and location decisions of workers.

1. **System design:** The majority of older transit systems were designed under a “hub-and-spoke” model that primarily focused on bringing residents from outlying neighborhoods and cities into the downtown of the central city. While some newer systems have been designed to connect multiple destinations throughout the region, most still tend to link most strongly to downtowns. While the central business districts have contained a declining share of total regional employment for decades, they are still the single largest density of jobs in most regions. These areas, which have both the largest number of jobs in most regions and the highest quality of transit service are also typically the least amenable to automobile access, with limited and/or expensive parking and significant traffic congestion. These conditions make transit a natural fit for the commute trip from suburban homes to central business districts
2. **Location decisions of employers:** There are myriad considerations affecting a firm’s location decision. These include land/building prices and availability; proximity to production inputs, to customers, and to complementary firms; neighborhood amenities and support services, and a host of other factors. For some firms, the benefits of density dictate a location in downtowns and other types of urban employment centers; the attendant transit access may be a secondary amenity. For other firms, however, labor may be the most critical input into operations and, consequently, access to a talented, high-skilled labor force is of critical importance, and a central location near transit may be essential to maximizing the ability draw from this labor pool.
3. **Location decisions of workers:** As with employers, residents decide where to live based on a vast array of factors, including home prices, amenities (both of the home and of the surrounding neighborhood), services, and a number of other highly idiosyncratic variables. However, ease of access to commonly visited destinations is often among the most important considerations in this decision. While work may represent only 18 percent of all trips, it is rare that a worker make

⁷ A Profile of Public Transportation Passenger Demographics and Travel Characteristics Reported in On-Board Surveys. American Public Transportation Association. 2007

trips to any other single destination as frequently. As such, for those that work (or may, in the future, work) in transit-accessible locations, its proximity to high quality transit may be an important factor in deciding where to live.

BENEFITS OF AGGLOMERATION

Literally meaning “to mass together,” agglomeration refers to the process through which firms, acting independently, elect to locate in close physical proximity to each other. Locating among large groups of firms (whether similar or unrelated) is said to confer benefits to individual firms; these benefits are known collectively as “economies of agglomeration.” Initiatives to facilitate agglomeration are often employed by local and regional economic developers in an attempt to attract new employment opportunities as well as to expand existing revenue streams. An extensive amount of empirical research has been performed to understand the benefits of agglomeration as well as the sources and effects. While a plethora of research has been produced in the pursuit of understanding the scale at which agglomerations occur, the approach in the literature review is to examine the benefits of agglomeration through the lens of Marshall’s classic view of agglomeration⁸. Furthermore, an emphasis is placed on gaining understanding as to what kinds of industries choose to agglomerate (businesses within the same industry) or co-agglomerate (businesses in complementary industries).

Geographic Proximity

Geographical proximity of industry promotes multiple benefits of agglomeration. The classic view of agglomeration in terms of geographical proximity maintains that firms, and industries, choose to concentrate as a method of mitigating transport costs.⁹ Firms are likely to make site location decisions that minimize transport costs from suppliers, inputs, as well as to minimize distribution costs to consumers. This site locator perspective inherently leads to industry agglomeration as firms within specific industries are driven by these benefits. This agglomeration is further reinforced through potential co-location, creating new scale economies, from intermediate suppliers who wish to take advantage of existing agglomerations.¹⁰ The production of final goods is therefore made more efficient through an increased variety of intermediate suppliers. An increased variety of intermediate goods will in turn make the production of final goods more efficient.^{11 12}

Labor Market Pooling

Labor market pooling is a fundamental facet of agglomeration economies for both firms and employees. At the firm level, agglomeration economies provide firms with the ability to attract knowledgeable and skilled workers from an existing workforce. Access to an experienced workforce provides firms with the ability to access potential employees without spending substantial amounts of resources on recruiting and hiring processes¹³. Agglomeration also affords workers with the opportunity to weather shocks to employment demand through access to firms within their set of skills and expertise. While employment demand at the firm level may fluctuate, industry demand could remain stable.¹⁴

⁸ Marshall, Alfred. *Principles of Economics*. London, UK: MacMillan and Co., 1920.

⁹ Ibid.

¹⁰ Holmes, Thomas. How industries migrate when agglomeration economies are important. *Journal of Urban Economics*, 45, 1999.

¹¹ Krugman, Paul. Increasing Returns and Economic Geography, *Journal of Political Economy*, 99, 1991.

¹² A. Ciccone and R. E. Hall. Productivity and the Density of Economic Activity, *American Economic Review*, 86, 1996.

¹³ Marshall, Alfred. *Principles of Economics*. London, UK: MacMillan and Co., 1920.

¹⁴ Le Blanc, Gilles. *Regional Specialization, Local Externalities and Clustering in Information Technology Industries*. Paris: Centre D’économie Industrielle, Ecole Nationale Supérieure Des Mines De Paris, 2000.

Knowledge Spillovers

Knowledge spillovers provide significant agglomeration incentives.¹⁵ The transference of information and knowledge intensifies with increased geographical proximity between firms.¹⁶ This transference of knowledge occurs in a variety of transactions that can take place within institutions such as formal business relationships as well as with more informal spillovers such as imitation. While the productivity advantages of knowledge spillovers have garnered the attention of economists for quite some time now, more recent work attempts to examine the relationship between innovation and agglomeration. It is in dense urban environments where the vast majority of substantial innovations emerge.¹⁷ The advantages of agglomeration, specifically through knowledge spillovers and shared inputs, can be realized by firms while maintaining flexibility and autonomy. The benefits of geographic concentration favor technological, organizational, and commercial innovation.¹⁸

ECONOMIC DEVELOPMENT BENEFITS OF TRANSIT

Transit is often a powerful force for facilitating both density and economic agglomeration. Because access to fixed-guideway transit occurs at stations that facilitate pedestrian orientation, the benefits of transit are especially concentrated over the area that is accessible on foot ($\frac{1}{4}$ to $\frac{1}{2}$ mile from the station). Therefore, firms that wish to take advantage of those benefits naturally cluster at these nodes at greater density than they might if they were oriented toward a roadway, where access is more defined by visibility than by “walkability”. For a variety of reasons, the benefits of agglomeration and density are likely to be amplified at these transit-oriented nodes and corridors.

Some employers may benefit from agglomeration in transit areas because they can take advantage of expanded access to the pooled workforce. This may include not only the transit-dependent, but also, increasingly, the “transit-dependent-by-choice.” This population, which includes a large number of young workers in knowledge-based sectors, prefers to live in more pedestrian- and bicycle-friendly urban areas and to not drive as a lifestyle choice. According to the Department of Transportation, the share of automobile miles driven by young people between 21 to 30 years old has dropped from 20.8 percent in 1995 to 13.7 percent in 2009.¹⁹ Similarly, the percentage of young people aged 19 and under with a driver’s license has declined from 64 percent of the age group in 1995 to 46 percent in 2009.²⁰

By accessing a larger, higher quality labor pool, employers may be able to attract and retain higher quality workers. In addition, because these workers often choose to live in “walkable” places where informal social encounters are more likely, access to transit may also facilitate knowledge spillovers.²¹ Each of these, in turn, is likely to augment productivity and profitability. A 2000 study by HLB concludes that cities with stronger transit are generally more efficient and productive than those lacking transit, and that

¹⁵ Marshall, Alfred. *Principles of Economics*. London, UK: MacMillan and Co., 1920

¹⁶ Romer, Paul. Increasing Returns and Long-run Growth. *Journal of Political Economy*, 103. 1986.

¹⁷ Puga, Diego. *The Magnitude and Causes of Agglomeration Economies*. Rep. Madrid: Madrid Institute for Advanced Studies, 2004.

¹⁸ Le Blanc, Gilles. *Regional Specialization, Local Externalities and Clustering in Information Technology Industries*. Paris: Centre D’économie Industrielle, Ecole Nationale Supérieure Des Mines De Paris, 2000.

¹⁹ Department of Transportation, Federal Highway Administration, National Household Travel Survey, 2010.

²⁰ U.S. Department of Transportation, Federal Highway Administration, Highway Statistics Series.
<http://www.fhwa.dot.gov/policy/ohpi/qfdrivers.cfm>

²¹ Saxenian, AnnaLee. *Regional Advantage: Culture and Competition in Silicon Valley and Route 128*. Harvard Press, 1994.

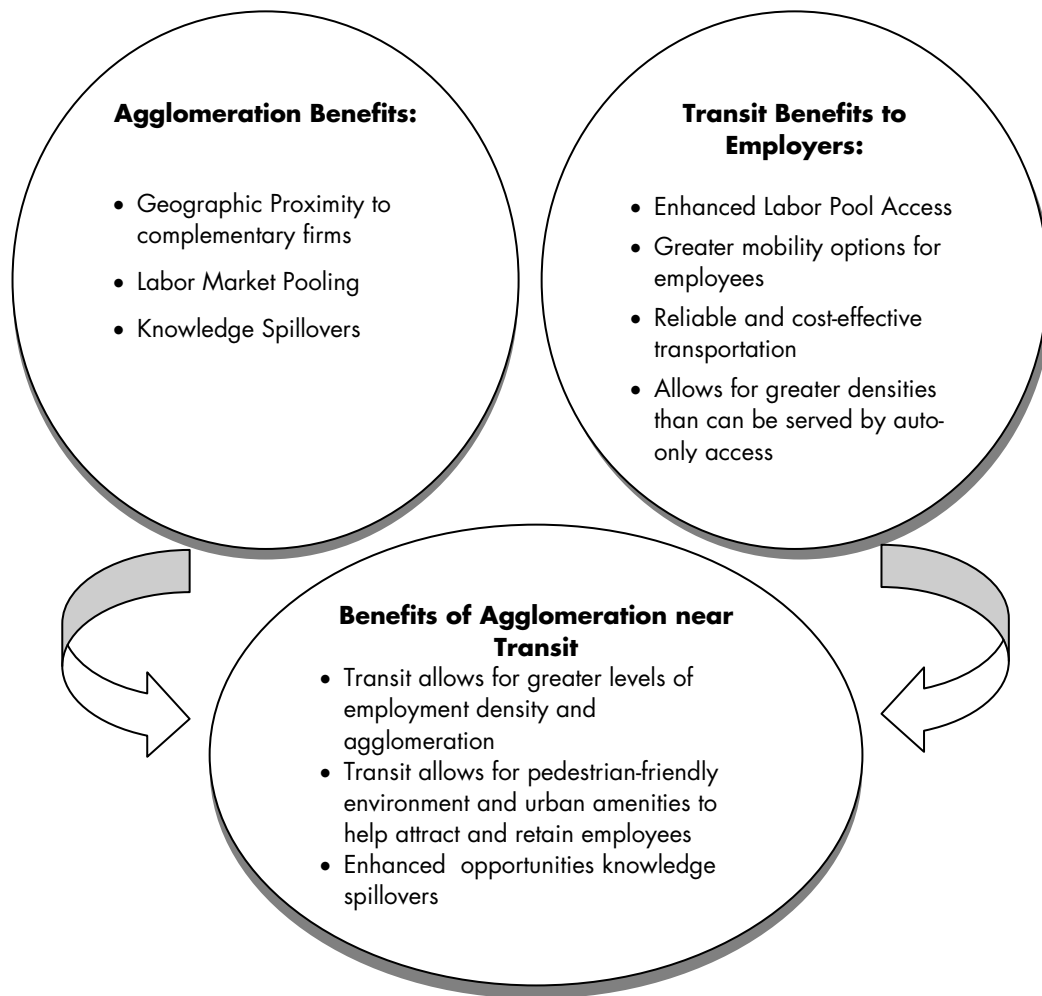
a 10 percent increase in transit presence (quantified as 50 vehicles) increases labor productivity by 0.4 percent annually.²²

In addition to these factors, whereby transit amplifies agglomeration benefits for certain types of firms, transit also helps to make such densification and agglomeration possible. In many municipalities, the presence of transit serves as a rationale for permitting greater building height and intensity. In such municipalities, where high-employment densities are not permissible elsewhere, areas that are transit-accessible are the only option for firms that benefit from agglomeration. In these scenarios, even firms that do not derive strong benefits from transit service are drawn to transit-oriented locations. In addition, in some areas, the potential for increasing density is limited by traffic congestion. This is a key factor in the decision to retrofit high capacity transit onto suburban employment centers, such as Tysons Corner, Virginia and the Warner Center in Los Angeles. Insofar as transit access provides additional transportation capacity without necessitating the provision of additional parking infrastructure, expanded roadway capacity, greater densities and levels of agglomeration are made possible.

The natural inclinations of certain firms to locate near transit or to take advantage of agglomeration benefits cannot be relied upon for the *generation* of new economic activity within a region. While broader macroeconomic trends are likely to have far greater influence on such economic growth, these inclinations may instead have a strong *distributional* effect on regional economic activity, determining where firms and residents decide to locate *within the region*. However, the potential for either generative or distributional economic development is dependent on the provision of other amenities, including infrastructure, services, and supportive policies.

²² Lewis, David, Khalid Bekka et al. *Transit Benefits 2000 Working Papers: A Public Choice Policy Analysis*. Federal Transit Administration Office of Policy Development, 2000.

Figure 1: Combined Transit and Agglomeration Benefits on Employment Location



“Edge Cities” and TOD

Tysons Corner, Virginia is one of the classic examples of an “edge city,” located approximately 13 miles from the Washington, D.C. central business district. The suburban employment center is strategically located near major highway interchanges and is highly automobile-oriented in its built form. With 27 million square feet of office space, 6 million square feet of retail space, and 115,000 employees, Tysons Corner qualifies as the 12th largest business district in the country.[†] However, with only 17,000 residents and a suburban setting far away from regional rapid transit, the area is famed for high traffic congestion on the roads serving the center (the Capital Beltway, Dulles Toll Road, and Leesburg Pike). While demand for office space remains strong, traffic congestion has become an obstacle to further intensification of office uses in the employment center. Planners have turned to strategies to reinvent the district into a mixed-use TOD by encouraging housing development in the area and enhancing transit access. At the behest of the Tysons Corner property owners, the Washington Metropolitan Area Transit Authority (WMATA) has started construction on the Silver Line, which will connect Tysons Corner to Dulles International Airport, Reston, and to the rest of the Metrorail system. Planners hope that this will help Tysons Corner to evolve into a walkable, mixed-use district, adding capacity for both job and housing growth, and limited impacts on the road network. The Silver Line construction is partly funded by a tax on commercial properties along the corridor, which was approved by a vote from property owners. The first phase of the line, which will include four stations in Tysons Corner, is expected to open in 2013.

REGIONAL BENEFITS OF LINKING TRANSIT AND EMPLOYMENT

There are several key factors that make locations in transit-rich urban agglomerations highly beneficial for certain industries and firms (Figure 1). However, the benefits of concentrating employment near transit do not accrue solely to the firms. Instead, it is the benefits to workers and to the region as a whole that are often most compelling to policymakers. For instance, just as transit may allow a firm to tap into a wider labor pool, the workers in that labor pool have enhanced access to employment. This is especially important for lower-income workers for whom automobile ownership may be a significant economic hardship, and for whom unchecked job sprawl would have the effect of economic isolation and impoverishment. A recent study of the Hiawatha Line light rail found that the new line significantly expanded access to low-wage jobs, implying that the transit was serving low-income workers.²³ Similarly, while the economies scale that attend agglomeration near transit may benefit firms in high density locations, such densities also help focus regional growth, curb sprawl, and limit automobile travel and pollution. Transit agencies across the country are continuing to adapt to challenging fiscal environments that are dramatically affecting service levels. “Transit-Oriented Development and Employment,” a recent publication from the Center for Transit-Oriented Development, recommends strategies to help shape transit service and travel demand in cities across the country. This work strongly suggests that one method of increasing ridership would be to focus TOD and regional transit planning to better serve existing employment areas. This could further be supported if state and regional economic development activities would focus on recruiting and retaining transit-supportive industries in transit served areas. Under this framework, what industries are most likely to be sensitive to such transit-oriented economic development policies? One way of addressing this question is by examining which industries are currently most likely to locate near transit. This is explored in the following section.

²³ Fan, Yingling, Andrew Guthrie, and David Levinson, *Impact of Light Rail Implementation on Labor Market Accessibility: A Transportation Equity Perspective*. Working Paper, 2010

[†] Meyer, Eugene. “A Shopping Center Outside Washington Plots a Future as an Urban Center.” *Washington Post*, December 16th, 2008

III. TRANSIT AND THE REGIONAL ECONOMY

In order to understand the relationship between transit and economic development, it is first important to establish the vocabulary of regional economies and the underlying industries that drive them. In this section of the report, CTOD provides a classification of industry types, discusses its role in the regional economy, and relates this to the sensitivity of each industry to particular types of locations.

INDUSTRY TYPES

The drive toward agglomeration and centralization is deeply linked to the role that each industry plays in the regional economy. Classically, the roles that these industries have been broken into two classes: basic and non-basic. Non-basic industries can be further parsed into “business-serving support” and “resident-serving” industries:

Basic Industries

“Basic” industries are those who sell their products or services primarily outside of the region that they are located. These include both larger manufacturing and distribution firms and more service oriented industries. In general, it is thought that these basic industries help to drive much of the economic growth of a region, as the sale of their goods and services brings new money into the region (which then gets spent on purchases from local support and resident-serving industries).

A subset of these basic industries tends to play a special role in driving regional economic growth. These innovation industries benefit strongly from knowledge-spillovers, and thus tend to strongly agglomerate in particular neighborhoods or subregions. Often these firms locate in the downtowns of major cities, though there are many cases where a more suburban context becomes the locus for such agglomerations (such as in the Silicon Valley). Regardless, because these firms (which vary from region to region) exhibit a high propensity for agglomeration, they are often the firms that are most amenable to locations near transit. Other basic industries that may be more well established and rely less on innovation may be less prone to agglomeration, and thus more sensitive to other factors in their location decisions.

Business-Serving Support Industries:

A business-serving support industry is one that sells goods or services to firms within the region. These include a wide range of types of firms, including retail, local-serving offices, and small-scale manufacturing and distribution operations.

Business-serving support industries exhibit a tendency to be agglomerate in central urban areas,²⁴ but only insofar as they serve other highly agglomerated businesses. Firms that serve less highly-agglomerated businesses or that engage in relatively few face-to-face meetings may be attracted to less expensive locations at the periphery of regions. These firms are not likely to rely on innovation for productivity and, consequently, and may not be as sensitive to knowledge spill-over benefits of agglomeration. However, these support-industries tend to serve a wide market, and thus will tend to choose strategic locations in places offering strong regional access.

²⁴ Sassen, Saskia *The Global City: New York, London, Tokyo*. Princeton University Press, 1991.

Resident-Serving Industries:

Resident-serving services (such as general merchandise stores) tend to make their location decisions based on the locations of their customers, and thus are highly prone to sprawling outward along with the population of a region. For example, many department stores have left downtowns in order to locate in suburban shopping malls. Some of the more quickly-evolving resident-serving industries (such as entertainment and cultural uses) benefit from clustering in compact retail and entertainment districts. Most, however, are motivated toward limited agglomeration based on geographic proximity to each other, deriving benefits from customers that wish to comparison shop and/or make multiple unrelated purchases on a single shopping trip. As such, resident-serving industries tend to be located within a large number of small clusters located throughout a region.

INDUSTRY GROUPS

The industry types described above can be applied to the North American Industry Classification System (NAICS) categories of businesses. A detailed listing of two-digit NAICS codes is provided in **Table 1**.

Table 1: NAICS²⁵ Industrial Sector Composition of Industry Groups

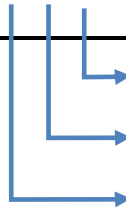
"Industry Group"	NAICS Code	Industrial Sector
Natural Resources	11	Agriculture
	21	Mining
Production, Distribution, and Repair (PDR)	31-33	Manufacturing
	42	Wholesale Trade
	48-49	Transportation and Warehousing
Retail	44-45	Retail Trade
Knowledge-Based	51	Information
	52	Finance and Insurance
	53	Real Estate
	54	Professional, Scientific, and Technical Services
	55	Management of Companies and Enterprises
Education and Medical	61	Educational Services
	62	Health Care and Social Assistance
Entertainment	71	Arts, Entertainment, and Recreation
	72	Accommodation and Food Services
Government	92	Public Administration
Other	22	Utilities
	23	Construction
	56	Administrative and Support and Waste Management and Remediation Services
	81	Other Services

Source: Center for Transit-Oriented Development, 2010

²⁵ The North American Industry Classification System (NAICS) is a taxonomy developed by the federal Office of Management and Budget to group similar industries. The most basic classification level is at the 2-digit, sector level.

While some NAICS two-digit industry sectors are primarily concentrated in one of these three industry categories, often they will span two or more. **Table 2** below illustrates this phenomenon across a selection of these sectors. For example, there are different types of manufacturing activities which can fall into basic or business-serving support industry types. A large automobile assembly plant can be understood as a basic industry business, while a wholesale bakery is a business-serving support business.

Table 2: Basic and Non-Basic Segmentation of NAICS Industry Sectors

NAICS Sector Breakdown		Manufacturing	Finance and Insurance	Education Services
	Basic →	Automobile Assembly	International Banking	Research Universities
	Business Support →	Wholesale Baking	Business Insurance	N/A
	Resident-Serving →	N/A	Commercial Banking	Elementary Schools

Source: Center for Transit-Oriented Development, 2010

For simplification, CTOD has grouped the NAICS industry groups described above into the following industry groups: Knowledge-based industries, Retail, Education and Medical, Entertainment, Government, and Production, Distribution and Repair. The NAICS codes corresponding to each of these groups is shown in Table 1.

Knowledge-Based Industry Group

The Knowledge-Based Industry Group includes the following NAICS 2-digit industry sectors: Information; Finance and Insurance; Real Estate; Professional, Scientific and Technical Services; and Management of Companies and Enterprises.

Much of the literature surrounding agglomeration benefits focuses solely on manufacturing industries while excluding service industries. However, in recent years, more attention has been given to service industries, and within these industries, what kind of firms choose to locate near each other. Service industries naturally gravitate towards each other due to the physical size of the product being offered.²⁶ That is to say that services industries are able to locate in more dense locations due not only to the size of facilities in terms of production requirements, but also the “size” of the product is smaller and may not require access to transportation networks such as freight rail and airports.

While the low transportation costs and building space requirements allow service firms to cluster more densely, it is their role within the regional economy that dictates whether they chose to do so. For instance, for a financial services firm that trades on national stock or commodities markets, the rapid transmission of information may be critical to business; such a firm may have a strong incentive to aggregate within a major financial services node. In contrast, local-serving financial services firms (such as commercial banks) may local closer to their customers, in smaller, peripheral, retail or general commercial nodes.

High-technology firms with a great deal of research and development activity are also considered to gain benefits from geographical clustering. There is some complexity to linking these types of firms to a specific two-digit NAICS industry code, since they often span several different categories, including

²⁶ Glaeser, E., H. Kallal, J. Scheinkman, and A. Shleifer. 1992. Growth in Cities. *Journal of Political Economy*, 100.

Manufacturing, Information, and Professional, Scientific and Technical Services. Nevertheless, it is widely agreed that areas of concentrated high-technology activity exhibit more promising opportunities for entrepreneurial firms.²⁷ It has been suggested that the advantages of agglomeration may be most beneficial to new entrants into high-technology industries. As resource constraints are oftentimes more prevalent in entrepreneurial firms, these entrants into knowledge-based industries could benefit most from agglomeration benefits.²⁸ At the output level, examination of patent intensity has led researchers to suggest that innovation increases with density within high-technology industries.²⁹ One prime example of technology industries taking advantage of agglomeration externalities is the biotech industry which is spatially structured in biotech clusters around the country. In addition to choosing locations in which firms may benefit from agglomeration, biotech firms also prefer to locate in areas with well developed infrastructure.³⁰ Inter-firm collaboration can play a substantial role in the success of new entrants into knowledge intensive industries. The clustering of innovation-based industries that occurs frequently in urban areas could be attributed not only to complementary requirements and products between technology industries, but also between different industries.³¹

Information technology industries provide an interesting glimpse into site location decision of firms, and the role that agglomeration benefits may play in making those decisions. A plethora of research has been focused on well-known knowledge- and IT-based industry specialization areas such as Silicon Valley in California and Route 128 in the Boston area.³² More recently, research has expanded beyond on these well known, and well documented, clusters of innovative information technology clusters to include burgeoning information technology clusters in areas such as Denver, Colorado and Houston, Texas.^{33 34} Literature suggests that sub-sectors within the IT industry are complementary, and that a mix of IT firms (e.g.-internet services, cable, software, and customer support) that support each other on different levels support IT agglomeration benefits.³⁵

Retail Trade

Although some kinds of retail may sometimes co-locate with tourism related activities (a “basic” industry), they are generally thought to be the purest examples of non-basic industries. As such, while each exhibits some agglomeration in regional centers, including downtowns, they are more likely to locate near customers. As such, these retailers are likely to decentralize along with businesses and housing.

Education and Medical

Like other many other services, education and medical sectors (represented by Educational Services; Health Care and Social Assistance sectors) represent a mix of basic and non-basic industries. For

²⁷ Rosenthal, Stuart, and William Strange. The Determinants of Agglomeration, *Journal of Urban Economics*, Vol. 50, 2001.

²⁸ Aharonson, Barak S., Joel A.C. Baum, and Maryann P. Feldman. *Desperately Seeking Spillovers? Increasing Returns, Social Cohesion and the Location of New Entrants in Geographic and Technological Space*. Rep. Toronto: Rotman School of Management, University of Toronto, 2004.

²⁹ Carlino, Gerald, Satyajit Chatterjee, and Robert Hunt. *Urban Density and the Rate of Invention*. Working paper. Federal Reserve Bank of Philadelphia, 2006.

³⁰ Sambidi, Pramod R. *Spatial Econometric Analysis of Agglomeration Economies Associated with the Geographical Distribution of the Biotech Industry*. Diss. Louisiana State University, 2007.

³¹ Le Blanc, Gilles. *Regional Specialization, Local Externalities and Clustering in Information Technology Industries*. Paris: Centre D'économie Industrielle, Ecole Nationale Supérieure Des Mines De Paris, 2000.

³² Saxenian, Annalee. *Regional Advantage: Culture and Competition in Silicon Valley and Route 128*. Harvard Press, 1994.

³³ *State of Texas Information and Computer Technology Cluster Assessment*. Rep. Dallas: Texas Information and Computer Technology Industry Cluster Team, 2004.

³⁴ Le Blanc, Gilles. *Regional Specialization, Local Externalities and Clustering in Information Technology Industries*. Paris: Centre D'économie Industrielle, Ecole Nationale Supérieure Des Mines De Paris, 2000

³⁵ Ibid

instance, elementary and secondary schools, as well as community colleges, are highly resident serving-governments will provide these in an almost direct relationship to their demand and will usually strive to place them close to users. Similarly, community-serving hospitals will tend to go where there is need/demand. As such, each of these has a tendency to sprawl and may not have a strong incentive to agglomerate near transit. The education and medical sectors also includes universities and research institutions, however- these institutions tend to serve a much larger population and may draw funding from national or international sources. As such, the location decisions of these intuitions are less sensitive to the location of customers, and more opportunistic.

Entertainment

The Entertainment industry group includes Arts, Entertainment, and Recreation; and Accommodation and Food Services sectors. There appears to be a positive effect of agglomeration for artistic and cultural services such as schools, dance studios, and art galleries. The literature suggests that the ability to share workers, technology, and marketing, compels artistic and cultural enterprises to locate in areas with a high concentration of similar firms.³⁶ These agglomerations are most likely to be in cultural centers in central cities are near major educational institutions.

Government

Despite being a non-market-based sector, Government (Public Administration) jobs also follow the general trend of aggregating more strongly the more they serve “customers” outside of the region. State and federal jobs, for instance, tend to cluster in central districts within capital or other major cities, with a much smaller number of jobs in “branch” offices. Often these jobs will not only be placed in areas with high employment densities, but will also be placed near transit as a matter of policy, to both support the transit system and facilitate access by employees and citizens. In contrast, municipal jobs tend to be located throughout the region, depending on the degree to which a region is politically fragmented.

Production, Distribution, and Repair

Firms in the Manufacturing; Transportation and Warehousing; and Wholesale Trade industries comprise the Production, Distribution and Repair (PDR) industry group. The PDR industries are dissimilar to all other firm-types in their propensity to agglomerate in centralized locations. While some PDR firms may benefit from central urban locations, many are sensitive to land prices and transportation costs, and find it more advantageous to be proximate to highways and rail. Land use conflicts, the high cost of doing business, and the conversion of industrial land to residential uses in major cities may further incent these firms to choose locations away from denser transit areas. As such, a non-basic firm may have some incentive to be located near the center of the region in order to reduce transportation costs, even as this may entail higher land costs. In contrast, a national- or international-oriented manufacturer has less incentive to do so, and may prefer inexpensive land on the edge of the metropolitan area.

³⁶ Gabe, Todd M. City-Industry Agglomeration and Changes in the Geographic Concentration of Industry. Rep. Morgantown: *Review of Regional Studies*, 2008.

IV. NATIONAL ANALYSIS OF EMPLOYMENT AND TOD

As discussed above, transit is a powerful tool for facilitating employment density and, therefore, agglomeration. However, there has been little research into whether the agglomeration that occurs near transit is of a similar nature to that occurring elsewhere in metropolitan regions. To address this question, Census Longitudinal Employment-Housing Dynamics (LEHD) data was examined for every transit region³⁷ in the US in 2002 and 2008.³⁸ In this analysis the type, number, and share of jobs were compared between blocks that lay within a half-mile of a fixed-guideway transit stop and those in the region as a whole.

For each industrial sector, CTOD examined the “transit zone capture rate,” meaning the share of that sector’s employment that is located within the areas accessible to fixed-guideway transit as compared the regions as a whole. We also examined how that capture rate changed from 2002 to 2008 and how employment changed in absolute numbers within transit zones over the same period.

For each analysis, the findings are disaggregated based on the size of the fixed-guideway transit system in each region, ranging from “small” to “extensive.” A list of transit regions with their system size is found in Appendix B.

TRANSIT-ORIENTED INDUSTRY SECTORS

As shown in **Figure 2**, on average for all transit regions in 2008, 23 percent of all employment (for a total of more than 14 million jobs) was located within a ½ mile of transit zones surrounding existing fixed-guideway transit stops. However, this “capture rate” varied considerably by industry. The Office of Management and Budget groups all industries into one of 20 sectors, each assigned a two-digit North American Classification System (NAICS) codes (referenced in see **Table 1** of this report).

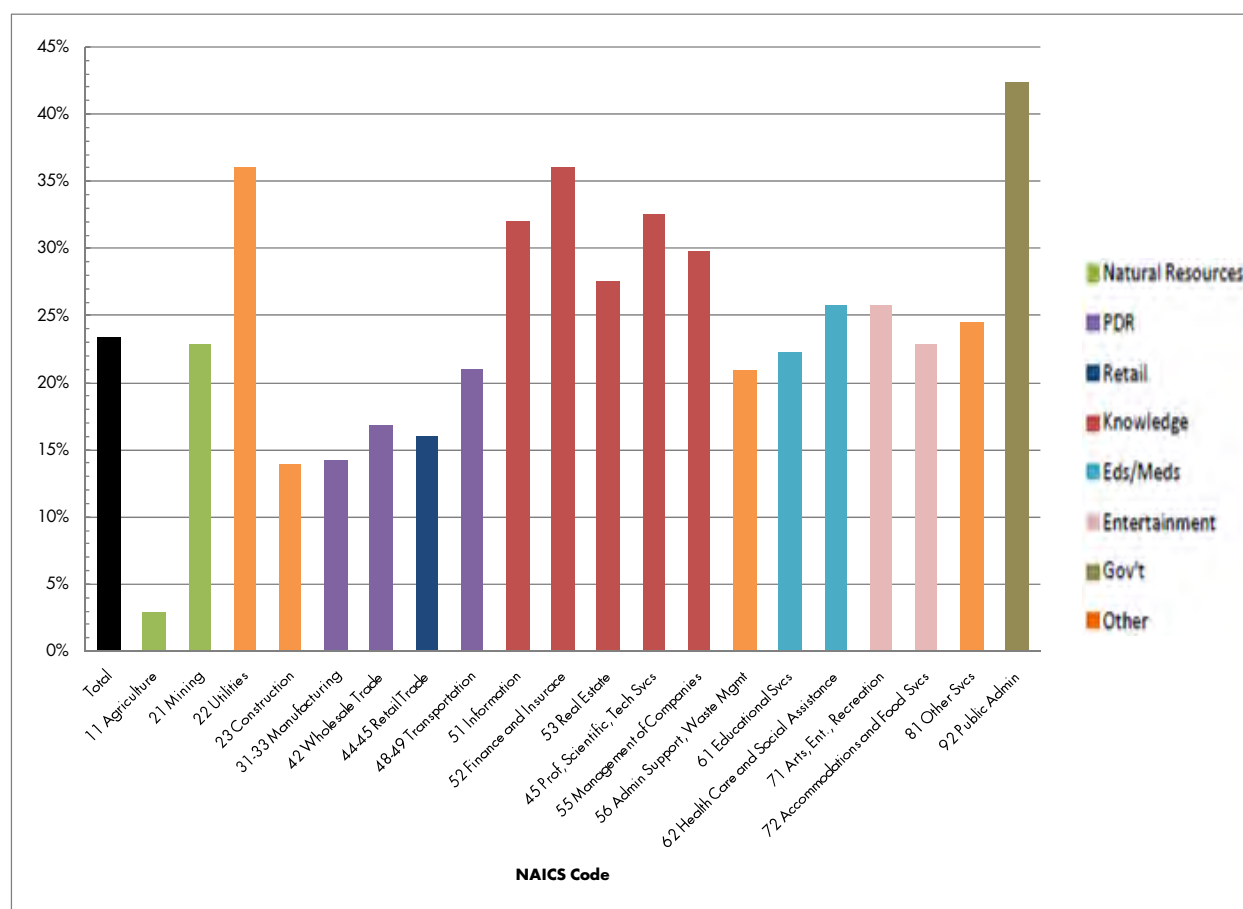
CTOD grouped these sectors into the industry groups described in Section II of this report, and include: Knowledge-based; Retail; Educational and Medical; Entertainment; Government; and Production, Distribution, and Repair.

Figure 2 suggests that government employment (colored in brown) had the greatest affinity for transit in 2008, with 42 percent of all jobs within this sector located in transit zones. Firms in knowledge-based industries (shown in red) were also more likely to be attracted to transit-rich locations, ranging from 28 percent of jobs (in Real Estate) to 36 percent of jobs (in Finance and Insurance) in these sectors near transit. At the other end of the spectrum, jobs in Production, Distribution, and Repair (PDR) industries (shown in dark blue) were far less likely to be near transit, ranging from 14 percent of Manufacturing jobs to 17 percent of Wholesale Trade jobs.

³⁷ Transit Regions are defined by the Center for Transit-Oriented Development, as represented in the TOD database. A list of transit regions and component jurisdictions are included in Appendix B

³⁸ The Boston, Washington DC, and San Juan metro areas were not included in this analysis because LEHD data is not available for major portions of the component geographies (Massachusetts, New Hampshire, DC, and Puerto Rico). In addition, 2002 data is not available for Arizona, Arkansas, and Mississippi; in lieu of 2002 data, 2003 data is used for Arkansas, while 2004 data is used for Arizona and Mississippi. Finally, 2008 data is not available for North Carolina; 2007 data is used instead.

Figure 2: Transit Zone Capture Rate by Sector, 2008



Source: LEHD 2008, Center for Transit Oriented Development 2010

This variation is a signal of important differences in how land, transportation, and labor force needs factor into the location decisions of firms. As noted above, public sector jobs are generally sited in central location, often in the central business district or, in some larger cities, in specialized “civic centers” adjacent to CBDs. In either case, being close to transit is important as a means of expanding access by citizens and employees. In addition, because these agencies are often involved in making decisions about where transit is cited, there is an enhanced probability that government centers are considered in transit planning.

As noted above, many knowledge-based jobs are sensitive to the benefits of locations in high density areas; many of these benefits are accentuated and facilitated by transit. In addition, as with public sector jobs, transit planners often likely to consider higher density employment centers as a means of both expanding employment access and relieving roadway congestion. Consequently, it would be expected that these industries have relative high capture rates in transit zones.

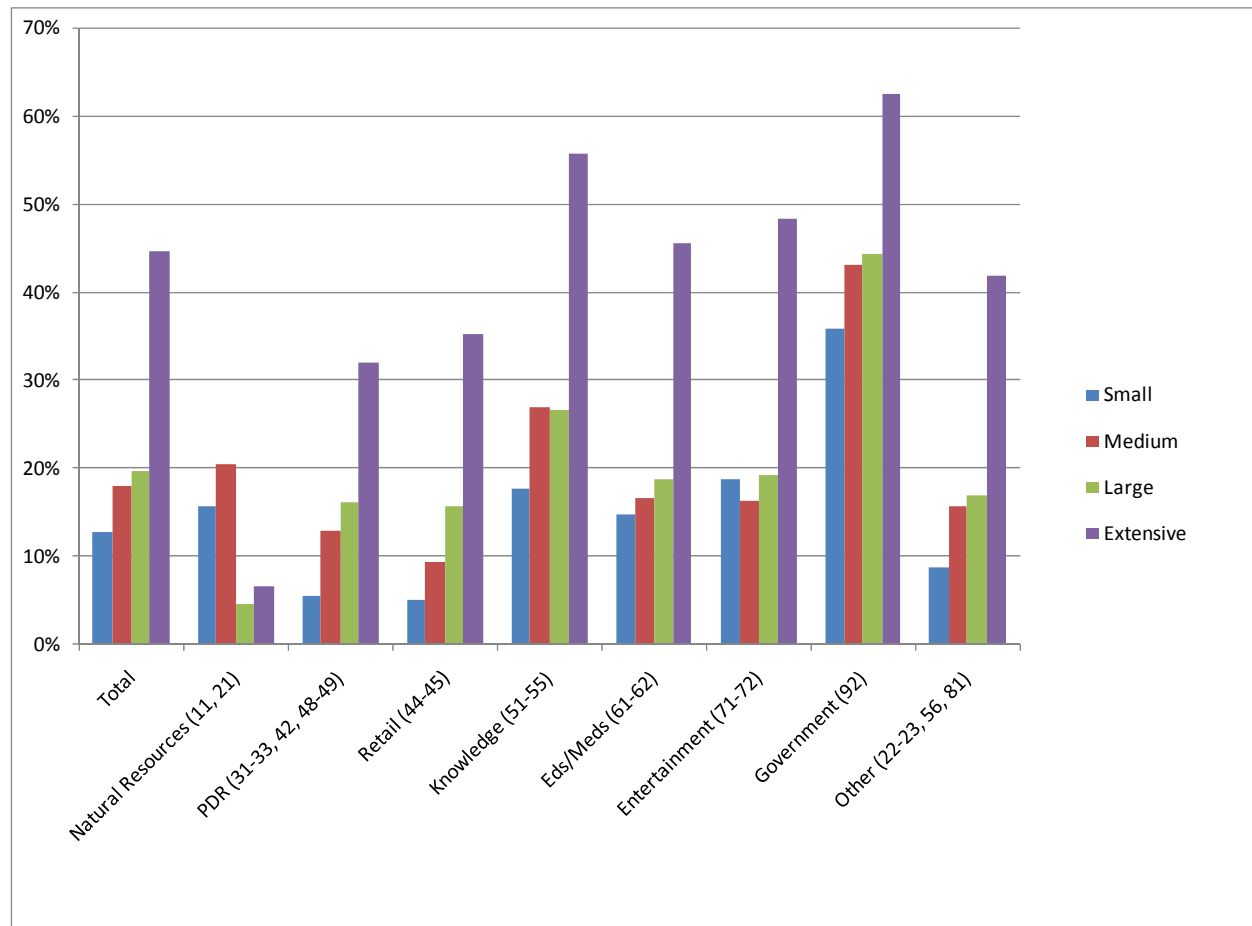
In contrast to public sector and knowledge-based industries, firms in PDR sectors are likely to be motivated by factors unrelated to transit in their location decisions. In addition to factors such as land and transportation costs, these firms often operate during non-traditional work hours; thus, proximity to transit may not significantly enhance accessibility to the labor pool for these firms. As a consequence, a lower share of these jobs is located in transit zones than in regions as a whole.

In addition to capture rates varying by sector, they are significantly influenced by the size of a region's transit system. CTOD sorted the results by the size of the transit system classified by the number of fixed-guideway stations (see Appendix B for more detail on transit systems by size):

Small – one to 24 stations
 Medium – 25 to 69 stations
 Large – 70 to 200 stations
 Extensive – 201 or more stations

As shown in **Figure 3**, the greater the number of stations in a region's transit system, the greater the share of its jobs were accessible by transit. The benefits to a firm of being close to transit increase with the number of places in the region accessible by transit. There was an especially significant increase from large systems (20 percent of jobs) to extensive systems (45 percent of jobs), suggesting that there may be a “tipping point,” after which these benefits are especially pronounced.

Figure 3: Transit Zone Capture Rate by Industry Group and by Transit System Size, 2008



Source: LEHD 2008, Center for Transit Oriented Development 2010

In part this is intuitive: in regions with more transit stations, it is likely that a larger portion of the land area (and, therefore, jobs) will be accessible by transit. However, this propensity for jobs to agglomerate

more around transit in larger systems varies by industrial sector. For instance, while in 2008, government jobs were clustered near transit at a higher rate in larger systems, the “capture rate” for these jobs is very high for all system sizes. Conversely, there was a negative association between system size and the capture rate for employment in Natural Resources industries (agriculture and mining). For most other industry groups, the variation in capture rates mirrored the average for most jobs, rising somewhat from small to medium and medium to large systems, then dramatically increasing from large to extensive systems.

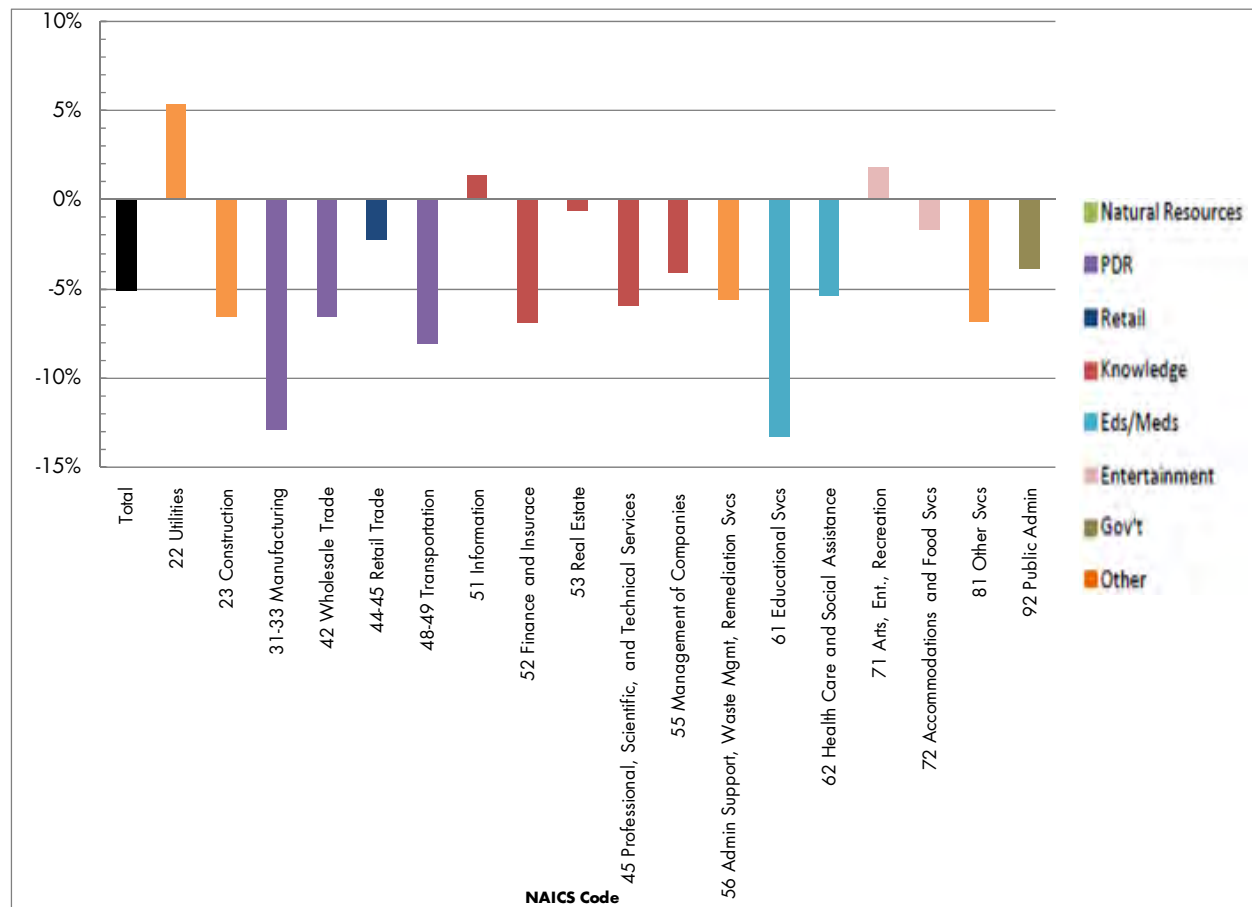
RECENT TRENDS

As shown in **Figure 4**, from 2002-2008, there was an overall decline in capture rates in transit zones of five percent, including declines for nearly all industries.³⁹ This is consistent with the pervasive job sprawl that occurred in most regions over this period, demonstrated in recent research by Kneebone (2009) finding that 95 of 98 metro areas experienced a decrease in the share of jobs located within three miles of central business districts.⁴⁰ Only the Utilities, Information, and Arts, Entertainment, and Recreation sectors had a greater rate of growth within transit zones than in the region as a whole. As shown in **Figure 5**, this was strongly associated with transit system size. In general, the larger the system, the smaller the discrepancy between regional job growth and transit zone job growth. In other words, regions with larger transit systems had less job sprawl to non-transit served areas from 2002-2008. Nevertheless, even regions with extensive systems had greater employment growth outside of transit zones, with the exception of the entertainment industries.

³⁹ A constant set of transit stations was used for 2002 and 2008 data points; if new transit stations were included, it is likely that the rate of change would be less negative or more positive.

⁴⁰ Kneebone, Elizabeth. Job Sprawl Revisited: The Changing Geography of Metropolitan Employment. *Brookings Institution*, 2009

Figure 4: Change in Transit Zone Capture Rate by Sector, 2002-2008



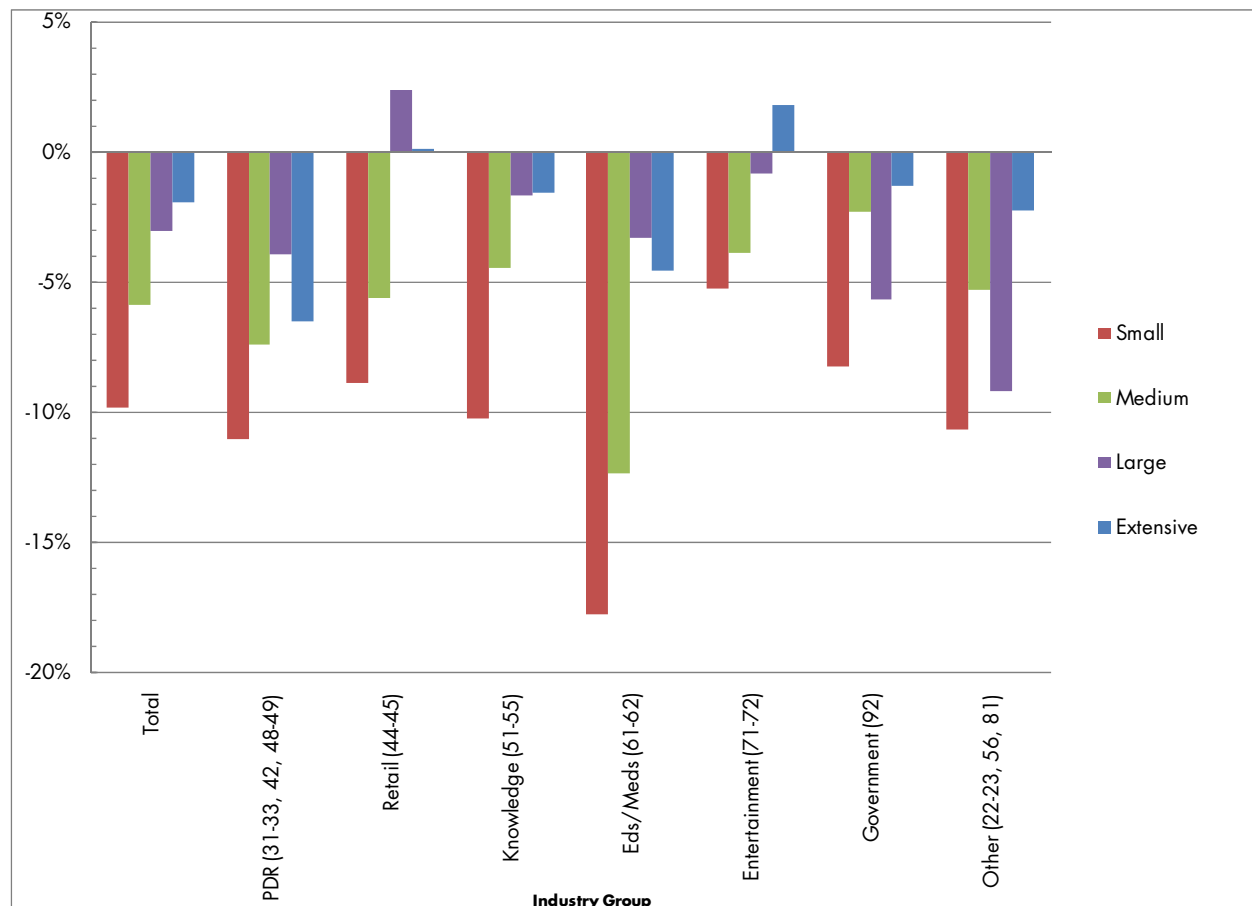
Source: LEHD 2008, Center for Transit Oriented Development 2010

However, while a smaller share of regional jobs were in transit zones in 2008 than 2002, employment growth within transit zones was still strong for many sectors (**Figure 6**). Overall, there was a one percent growth in employment in transit zones. However, this is partly driven downward by a 22 percent drop in land-intensive manufacturing jobs, many of which may have been replaced by higher-intensity uses. Nearly every other sector either had positive growth or much more modestly negative growth over this period. The related sectors of Arts, Entertainment, and Recreation and Food and Accommodation each grew by 14 percent over this period, while Health Care and Social Assistance and Professional, Scientific, and Technical also posted strong gains of 10 percent and 9 percent, respectively. Unlike with capture rates, this employment growth does not seem to be strongly related to system size (

Figure 7).

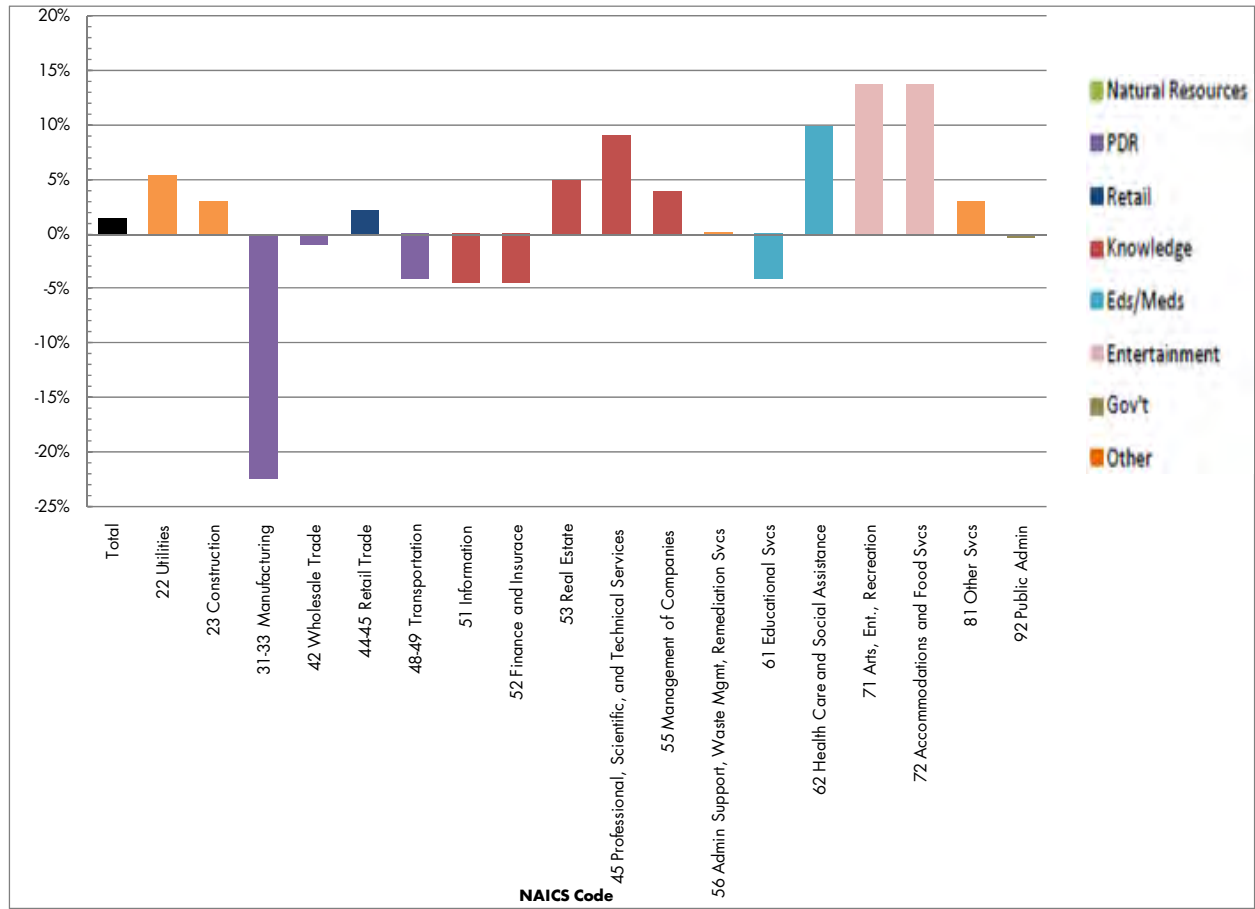
The finding that many sectors posted strong employment growth within transit zones, even while growing at a greater rate elsewhere in the region, presents a counterpoint to the narrative of job sprawl. The continued growth of jobs within transit suggests that job sprawl may not be due entirely to a lack of demand for locations in transit zones high land costs and limited land availability associated with a constrained supply of locations in transit zones are also important factors. Growth in Health Care, Entertainment, and Professional Services points to these sectors as especially important determinants of future TOD demand from employers.

Figure 5: Change in Transit Zone Capture Rate by Industry Group and by Transit System Size, 2002-2008



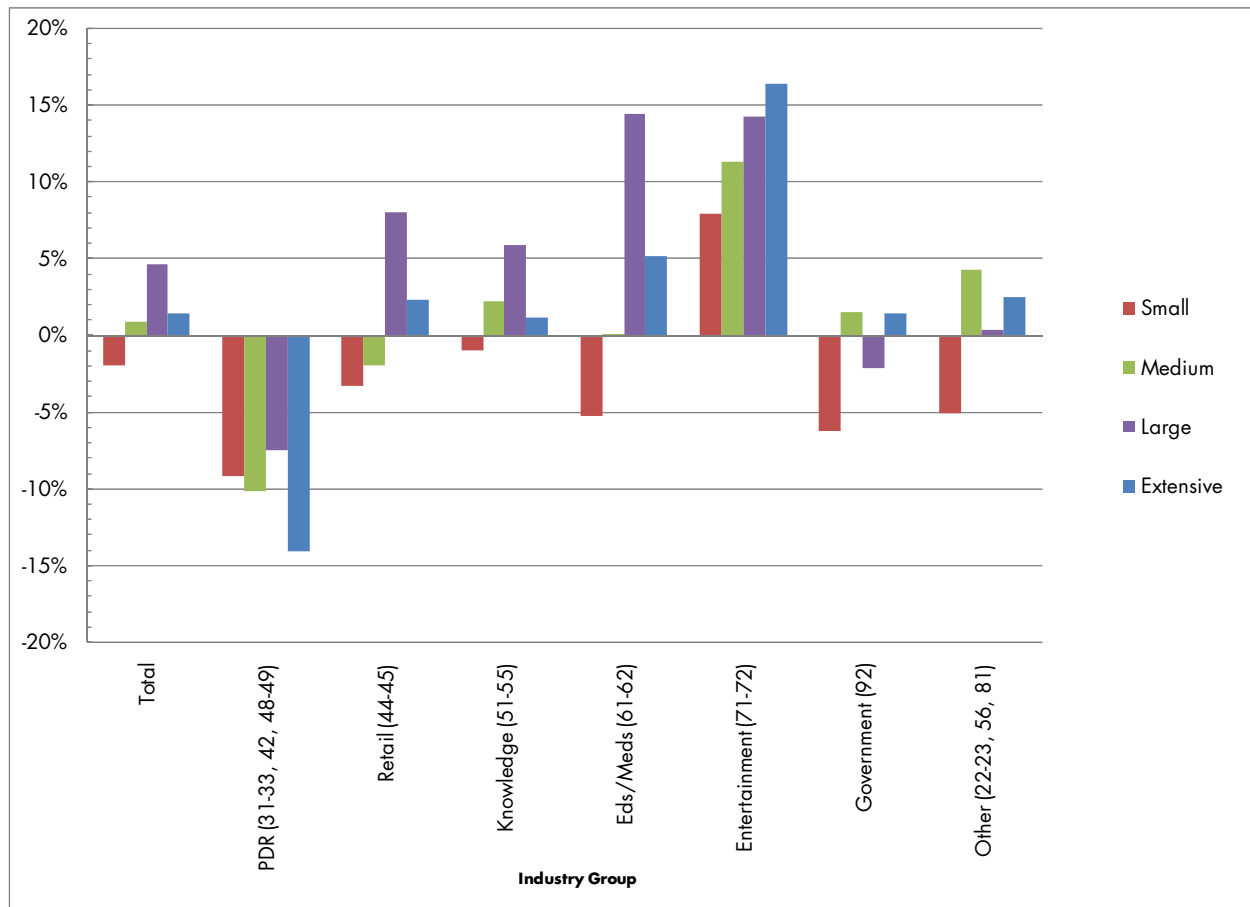
Source: LEHD 2008, Center for Transit Oriented Development 2010

Figure 6: Change in Employment within Transit Zones by Sector, 2002-2008



Source: LEHD 2008, Center for Transit Oriented Development 2010

Figure 7: Change in Employment within Transit Zones by Industry Group and by Transit System Size, 2002-2008



Source: LEHD 2008, Center for Transit Oriented Development 2010

THE SECTORAL COMPOSITION OF TRANSIT-RICH LOCATIONS

In addition to identifying the types of firms that are located near transit and recent trends in the sectoral mix of transit-oriented employment, CTOD also examined the relationship between employment density and industry mix in transit areas. Using LEHD data, CTOD analyzed every existing station area⁴¹ in the United States, classified by employment density, to determine how employment within these transit zones tends to be distributed among the 2-digit NAICS sectors listed above.⁴²

In categorizing densities, CTOD designated as Very High employment density some of the most intensely developed employment centers in the country, such as those in the downtowns of New York, Chicago, San Francisco, and Philadelphia. Station areas categorized as have Very Low employment density primarily included places that were largely rural and, such as the stations near the ends of Washington, DC's MARC and VRE and Chicago's METRA commuter lines. However, it also included places dominated by parking lots and/or difficult topography (such as South Hills Junction in Pittsburgh) and suburban places in almost exclusively residential use (such as the Ardmore Avenue R100 station outside of Philadelphia). Station areas that fell in Low, Medium, and High employment density categories fell between these two extremes, including urban mixed-use neighborhoods, suburban employment centers. **Table 3** below describes the employment density categories, including the range of employees per acre, and examples of station areas that fall under each category.

Table 3: Description and Examples of Stations by Employment Density Category

Category	# of Jobs	Employment Density (per acre)	# of Station Areas	Examples
Very Low	0 - 2,499	0 - 5	884	Harpers Ferry (WV, MARC); Montauk (NY, MTA); South Hills Junction (PA, PAAC)
Low	2,500 - 9,999	5 - 20	1328	Roseville (CA, Amtrak); Radnor (PA, SEPTA); Cicero (IL, METRA)
Medium	10,000 - 24,999	20 - 50	436	Bloomington Central (MN, Metro Transit); Elizabeth (NJ, NJ Transit); Boca Raton (FL, Tri-Rail)
High	25,000 - 74,999	50 - 150	302	Convention Center (TX, DART); Main Library Station (UT, UTA); Bethesda (MD, WMATA)
Very High	75,000 or Greater	150 or Greater	235	34th Street-Penn Station (NY, MTA/Amtrak); Clark/Lake (IL, CTA); Montgomery Street (CA, BART/MUNI)

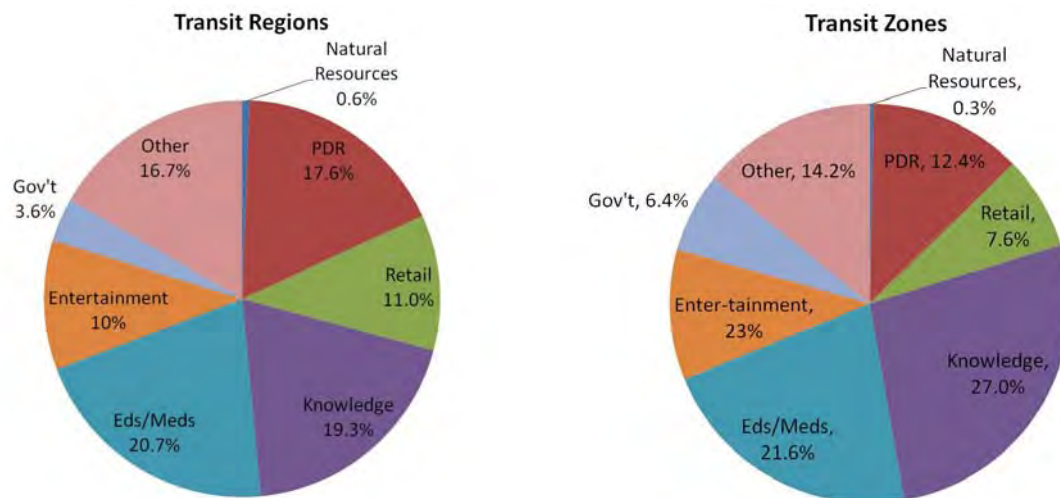
Source: Center for Transit-Oriented Development, 2010

⁴¹ For this paper, a station area is defined as the area within a half-mile radius of a fixed-guideway transit station.

⁴² 2008 LEHD data was used to calculate total jobs within each station area. Since each station area is defined by a half-mile radius, each is equal area (503 acres). Given that each station area is of equal area, relative density and total jobs can be used interchangeably.

As shown in **Figure 8**, as compared to transit regions as a whole, transit zones tend to be far more composed of industries in the knowledge-based industrial sectors (transit zone: 27 percent to transit region: 19 percent). In addition, government jobs comprise a larger share of station area jobs than in the region as whole (transit zone: six percent to transit region: four percent). For both Entertainment and Medical and Educational industry groups, jobs are a nearly equivalent portion of station area jobs as regional jobs (11 percent for both geographies for Entertainment and 22 percent and 21 percent, respectively, for Medical and Educational). Finally, both retail (transit zone: 8 to transit region: 11 percent) and PDR jobs (transit zone: 12 to transit region: 18 percent) are a considerably lesser portion of station area jobs than in transit regions as a whole. This conforms to the findings of the previous section regarding which types of industries are more likely to be located near transit. However, it also suggests that there is a broad range of industries within station areas. Even the knowledge-based sectors, which constitute the single largest share of transit zone employment, account for barely more than a quarter of jobs within a half-mile of transit stations. PDR jobs, which are represented poorly in station areas relative to the region as a whole, and have declined in absolute numbers since 2002, still constituted more than ten percent of station area jobs in 2008.

Figure 8: Employment Composition of Transit Regions and Transit Zones by Industry Group, 2008



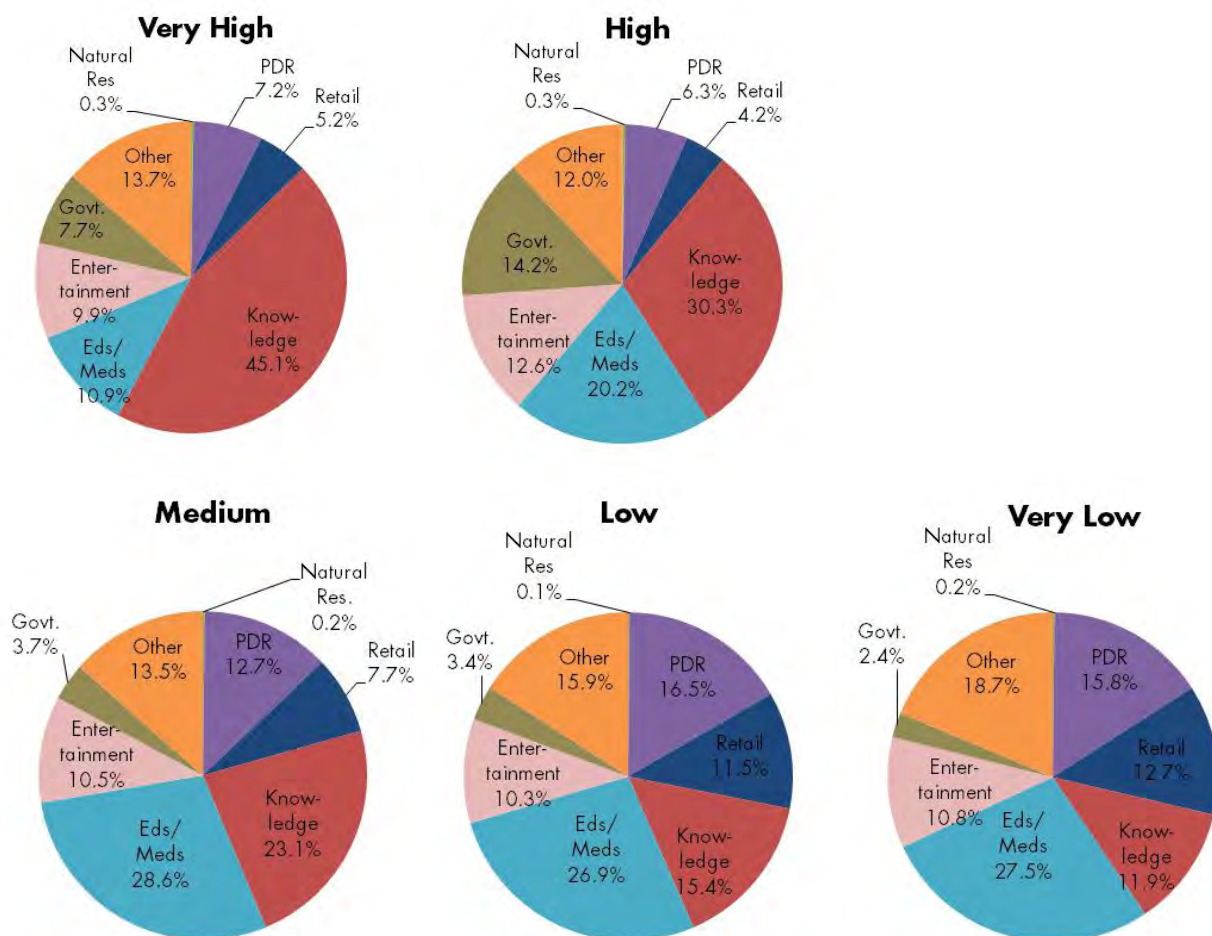
Source: LEHD 2008, Center for Transit Oriented Development 2010

EMPLOYMENT COMPOSITION BY DENSITY AND INDUSTRY GROUP

In part, the wide variety of industrial sectors represented in station areas is a reflection of the wide variety of places served by transit. **Figure 9** illustrates how the employment composition of station areas varies by the employment density of station areas. This chart suggests that a clear association between these two variables, with certain industry groups much more prevalent in places with high employment density, and others more prevalent in lower density or primarily residential station areas.

Of all the industry groups depicted in **Figure 9**, the prevalence of Knowledge-based industries varies most strongly with the employment density of a station area. In places with Very High employment density, these industries account for 45 percent of jobs; in Very Low employment density station area, only 15 percent of jobs are in these industries. In part, this is due to the configuration of office-based work places. Generally, firms in this industry have a larger number of employees per square foot of building space, relative to other industries, such as retail or manufacturing. Consequently, the presence of these industries tends to boost the overall employment density of a place. However, much of this is due to the strong agglomeration preferences of these industries.

Figure 9: Employment Composition of Station Areas, by Employment Density and Industry Group, 2008



Source: LEHD 2008, Center for Transit Oriented Development 2010

Often, these firms are willing pay more for locations in close proximity to related firms, which both increases building densities and crowds out industries that cannot afford higher rents. Because areas with the highest employment density area often those with the highest level of transit service, the enhanced labor access and amenities associated with transit further fuel this process. As shown in **Figure 12**, the Finance and Insurance and Professional, Scientific, and Technical Services especially dominate these Very High density locations. In contrast, **Figure 10** illustrates that, in Very Low employment density locations, there is a more even distribution among the office-, knowledge-based industrial sectors

There is also a positive association between the employment density of a place and the prevalence of government employment. However, unlike with the knowledge-based industries, places with the greatest presence of public sector jobs are not those with the very highest employment density. Instead, these jobs most commonly agglomerate in the next tier, places with High employment density. Often, these are places very near to a city's highest density employment center, such as with San Francisco's Civic Center.

Medical and educational uses tend to be highly space intensive, but highly idiosyncratic in their size, configuration, and tendency to agglomeration. For instance, medical offices will often co-locate with hospitals, but this is less likely to happen in hospitals that have internalized a full range of services. Depending on their mission, educational institutions may either seek to be as close as possible to employment centers (as with schools serving mid-career adults) or far away (as with resident-serving elementary and high schools or residential colleges). Consequently, it is somewhat more difficult to generalize about the place types in which these industries tend to agglomerate. Unlike the public sector and other office- employment, medical and education jobs are least prevalent in the High and Very High employment density station areas. However, there is little gradation in this industry group's representation in the employment of the three lower density and residential station areas, with 27 to 29 percent of jobs in each of these place types.

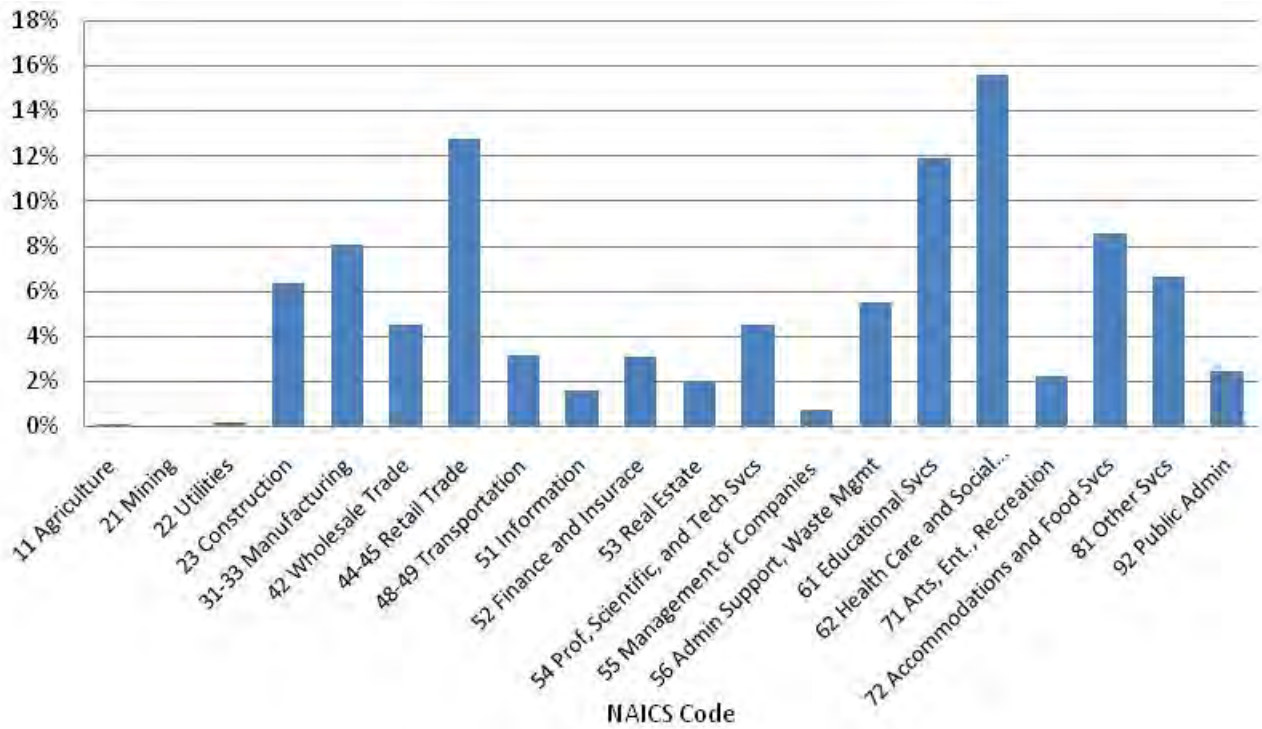
As shown in **Figure 10**, **Figure 11** and **Figure 12**, Entertainment industries represent a somewhat constant share of employment across transit-served locations. These sectors range between 10 and 13 percent for all station area types, with no clear relationship to density. In low-density contexts, these tend to be small-scale, resident serving uses; in high-density contexts, these are more likely to be in the form of entertainment districts, serving workers, local residents, and broader portions of the region.

Retail industries tend to decline in their prevalence as the employment density of a station area increases. As shown in **Figure 11**, in Very Low employment density station areas, Retail represents 13 percent of jobs and is the second largest sector, after Health Care and Social Assistance. In Very High employment density places, however, Retail represents only 5 percent of jobs.

Finally, as with Retail, PDR industries are most common in station areas with the lowest employment densities. As shown in **Figure 10**, **Figure 11** and **Figure 12**, this is driven by manufacturing, which 8 percent of employment in Very Low employment density station areas, but only 2 percent of employment in station areas with Very High employment density. Often land-intensive, noxious, and dependent on high-capacity transportation infrastructure, firms in these generally prefer locations away from higher-intensity uses.

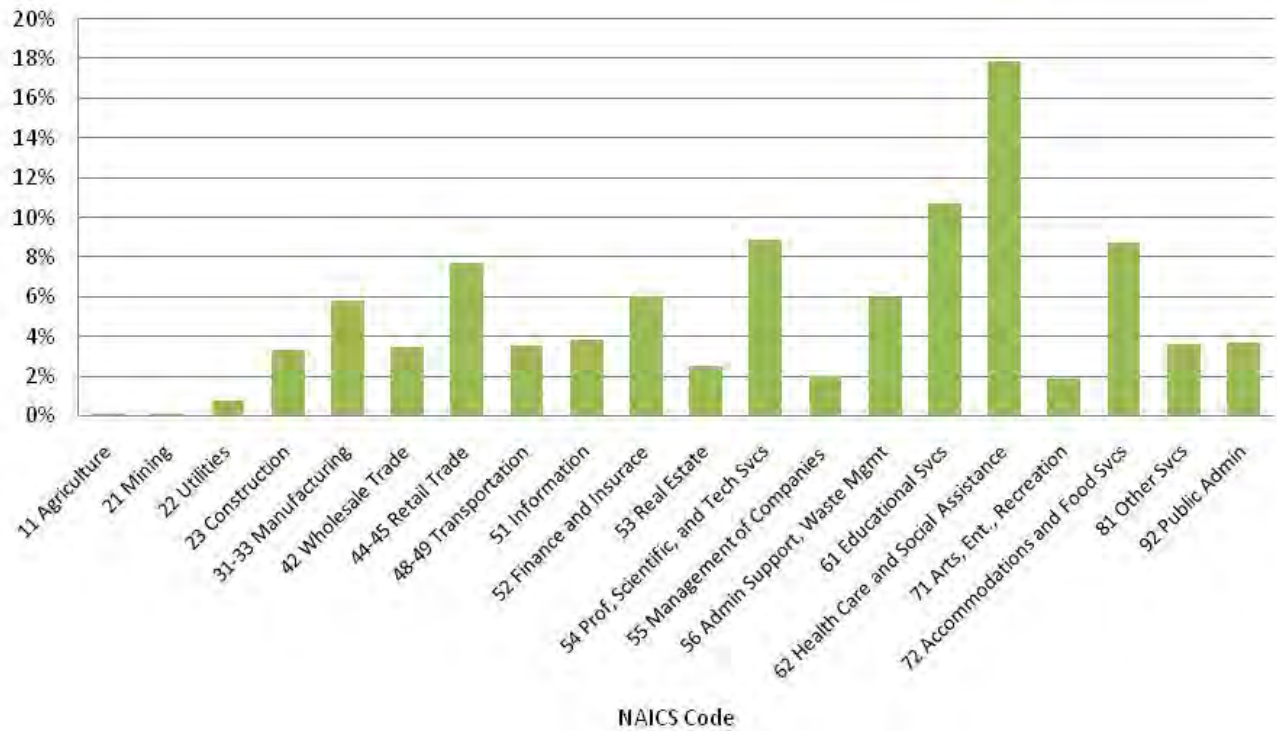
This analysis demonstrates that, in addition to varying by region and transit system size and by industrial sector, demand for transit-rich accessible locations is highly dependent on the context of the place. Varying preferences for agglomeration, not only within a given industry, but also within different place types is critical for anticipating and planning for employment growth near transit.

Figure 10: Employment Composition of Station Areas with Very Low Employment Density, by Sector, 2008



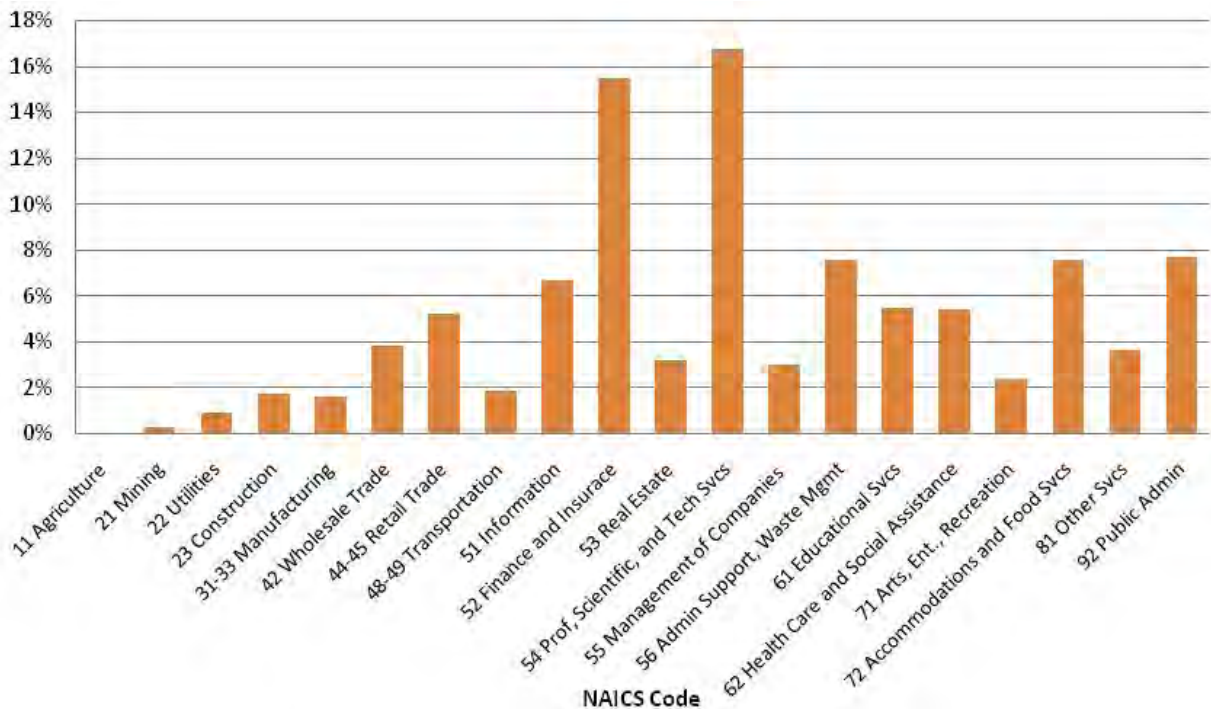
Source: LEHD 2008, Center for Transit Oriented Development 2010

Figure 11: Employment Composition of Station Areas with Medium Employment Density, by Sector, 2008



Source: LEHD 2008, Center for Transit Oriented Development 2010

Figure 12: Employment Composition of Station Areas with Very High Employment Density, by Sector, 2008



Source: LEHD 2008, Center for Transit Oriented Development 2010

APPENDIX A: GLOSSARY OF TERMS

Agglomeration- Literally meaning “to mass together,” agglomeration is in this paper specifically to refer to the process that through which firms, acting independently, elect to locate in close physical proximity to each other. Locating among large groups of firms (whether similar or unrelated) is said to confer benefits to individual firms; these benefits are known collectively as “economies of agglomeration.” Major benefits of agglomeration are explained starting on page 9 of this report

Capture Rate- As used in this paper, this is the percentage of regional jobs located in station areas. There are three types of capture rates employed in the analyses:

<i>Capture or Baseline Capture Rate -</i>	The percentage of regional jobs located within station areas at a single point in time
<i>Incremental Capture Rate -</i>	The share of regional growth in an industry, over a given period of time, that took place within station areas
<i>Projected Capture Rate -</i>	The incremental rate, used to build scenarios, that is applied to regional growth to model potential growth within station areas

Economic Development- a set of theories, policies, and practices aimed at building a geographic area’s long-term structural capacity for economic growth, by fostering a skilled workforce, strong infrastructure, and an inter-related network of firms. Economic development also includes activities that aim at distributing/focusing economic activity to various geographic or social segments of a city or region.

Fixed-Guideway Transit - Fixed-guideway transit includes commuter rail, light rail, trolley, streetcar, and selected bus rapid transit (BRT) corridors.

NAICS Codes- The North American Industry Classification System is a taxonomy developed by the federal Office of Management and Budget to group similar industries. The most basic classification level is at the 2-digit, sector level. These sectors are as follows:

Code	Sector
11	Agriculture
21	Mining
22	Utilities
23	Construction
31-33	Manufacturing
42	Wholesale Trade
44-45	Retail Trade
48-49	Transportation and Warehousing
51	Information
52	Finance and Insurance
53	Real Estate
54	Professional, Scientific, and Technical Services
55	Management of Companies and Enterprises
56	Administrative and Support and Waste Management and Remediation Services
61	Educational Services
62	Health Care and Social Assistance
71	Arts, Entertainment, and Recreation
72	Accommodation and Food Services
81	Other Services
92	Public Administration

Station Area- the area defined by a circle with a half-mile radius surrounding a fixed-guideway transit station

Transit Region- a metropolitan region, geographically defined by the Center for Neighborhood Technology, and served by at least one fixed-guideway transit corridor. Geographic definitions for each transit region considered in this paper are included in Appendix B.

Transit Zone- the area defined by a circle with a half-mile radius surrounding a fixed-guideway transit station.

APPENDIX B: TRANSIT REGIONS AND SYSTEM SIZES

Transit Region	System Size	Component Geographies	
		County	State
Albuquerque	Small	Bernalillo	New Mexico
		Sandoval	New Mexico
		Valencia	New Mexico
Atlanta	Medium	Barrow	Georgia
		Bartow	Georgia
		Carroll	Georgia
		Cherokee	Georgia
		Clayton	Georgia
		Cobb	Georgia
		Coweta	Georgia
		DeKalb	Georgia
		Douglas	Georgia
		Fayette	Georgia
		Forsyth	Georgia
		Fulton	Georgia
		Gwinnett	Georgia
		Henry	Georgia
		Newton	Georgia
		Paulding	Georgia
		Pickens	Georgia
		Rockdale	Georgia
		Spalding	Georgia
		Walton	Georgia
Baltimore	Medium	Anne Arundel	Maryland
		Baltimore	Maryland
		Carroll	Maryland
		Harford	Maryland
		Howard	Maryland
		Queen Anne's	Maryland
		Baltimore	Maryland
Buffalo	Small	Erie	New York
		Niagara	New York

Transit Region	System Size	Component Geographies	
		County	State
Charlotte	Medium	Cabarrus	North Carolina
		Gaston	North Carolina
		Lincoln	North Carolina
		Mecklenburg	North Carolina
		Rowan	North Carolina
		Union	North Carolina
		York	South Carolina
Chicago	Extensive	Cook	Illinois
		DeKalb	Illinois
		DuPage	Illinois
		Grundy	Illinois
		Kane	Illinois
		Kendall	Illinois
		Lake	Illinois
		McHenry	Illinois
		Will	Illinois
Cleveland	Medium	Ashtabula	Ohio
		Cuyahoga	Ohio
		Geauga	Ohio
		Lake	Ohio
		Lorain	Ohio
		Medina	Ohio
Dallas	Medium	Collin	Texas
		Dallas	Texas
		Denton	Texas
		Ellis	Texas
		Henderson	Texas
		Hood	Texas
		Hunt	Texas
		Johnson	Texas
		Kaufman	Texas
		Parker	Texas
		Rockwall	Texas
		Tarrant	Texas
Denver	Medium	Adams	Colorado
		Arapahoe	Colorado
		Boulder	Colorado
		Broomfield	Colorado
		Denver	Colorado
		Douglas	Colorado
		Jefferson	Colorado

Transit Region	System Size	Component Geographies	
		County	State
Eugene	Small	Lane	Oregon
Galveston	Small	Galveston	Texas
Harrisburg	Small	Cumberland	Pennsylvania
		Dauphin	Pennsylvania
		Lancaster	Pennsylvania
		Lebanon	Pennsylvania
		Perry	Pennsylvania
Houston	Small	Chambers	Texas
		Fort Bend	Texas
		Harris	Texas
		Liberty	Texas
		Montgomery	Texas
		Waller	Texas
Jacksonville	Small	Clay	Florida
		Duval	Florida
		Nassau	Florida
		St. Johns	Florida
Las Vegas	Small	Mohave	Arizona
		Clark	Nevada
		Nye	Nevada
Little Rock	Small	Faulkner	Arkansas
		Lonoke	Arkansas
		Pulaski	Arkansas
		Saline	Arkansas
Los Angeles	Large	Los Angeles	California
		Orange	California
		Riverside	California
		San Bernardino	California
Memphis	Small	Crittenden	Arkansas
		DeSoto	Mississippi
		Fayette	Tennessee
		Shelby	Tennessee
		Tipton	Tennessee
Miami	Medium	Broward	Florida
		Miami-Dade	Florida
		Palm Beach	Florida

Transit Region	System Size	Component Geographies	
		County	State
Minneapolis- St. Paul	Small	Anoka	Minnesota
		Carver	Minnesota
		Chisago	Minnesota
		Dakota	Minnesota
		Hennepin	Minnesota
		Isanti	Minnesota
		Ramsey	Minnesota
		Scott	Minnesota
		Sherburne	Minnesota
		Washington	Minnesota
		Wright	Minnesota
		Pierce	Wisconsin
		St. Croix	Wisconsin
Nashville	Small	Cheatham	Tennessee
		Davidson	Tennessee
		Dickson	Tennessee
		Robertson	Tennessee
		Rutherford	Tennessee
		Sumner	Tennessee
		Williamson	Tennessee
		Wilson	Tennessee
New Orleans	Small	Jefferson	Louisiana
		Orleans	Louisiana
		Plaquemines	Louisiana
		St. Bernard	Louisiana
		St. Charles	Louisiana
		St. James	Louisiana
		St. John the Baptist	Louisiana
		St. Tammany	Louisiana

Transit Region	System Size	Component Geographies	
		County	State
New York	Extensive	Fairfield*	Connecticut*
		Middlesex*	Connecticut*
		New Haven*	Connecticut*
		Bergen	New Jersey
		Essex	New Jersey
		Hudson	New Jersey
		Hunterdon	New Jersey
		Mercer	New Jersey
		Middlesex	New Jersey
		Monmouth	New Jersey
		Morris	New Jersey
		Ocean	New Jersey
		Passaic	New Jersey
		Somerset	New Jersey
		Sussex	New Jersey
		Union	New Jersey
		Warren	New Jersey
		Bronx	New York
		Dutchess	New York
		Kings	New York
		Nassau	New York
		New York	New York
		Orange	New York
		Putnam	New York
		Queens	New York
		Richmond	New York
		Rockland	New York
		Suffolk	New York
		Westchester	New York
		Pike	Pennsylvania
Philadelphia	Extensive	Burlington	New Jersey
		Camden	New Jersey
		Gloucester	New Jersey
		Salem	New Jersey
		Berks	Pennsylvania
		Bucks	Pennsylvania
		Chester	Pennsylvania
		Delaware	Pennsylvania
		Montgomery	Pennsylvania
		Philadelphia	Pennsylvania

Transit Region	System Size	Component Geographies	
		County	State
Pittsburgh	Large	Allegheny	Pennsylvania
		Beaver	Pennsylvania
		Butler	Pennsylvania
		Fayette	Pennsylvania
		Washington	Pennsylvania
		Westmoreland	Pennsylvania
Portland	Large	Clackamas	Oregon
		Columbia	Oregon
		Multnomah	Oregon
		Washington	Oregon
		Yamhill	Oregon
		Clark	Washington
Sacramento	Medium	El Dorado	California
		Placer	California
		Sacramento	California
Salt Lake City	Small	Davis	Utah
		Salt Lake	Utah
		Weber	Utah
San Diego	Large	San Diego	California
San Francisco	Extensive	Alameda	California
		Contra Costa	California
		Marin	California
		Napa	California
		San Francisco	California
		San Mateo	California
		Santa Clara	California
		Solano	California
Seattle	Medium	Island	Washington
		King	Washington
		Pierce	Washington
		Snohomish	Washington

Transit Region	System Size	Component Geographies	
		County	State
St. Louis	Medium	Clinton	Illinois
		Jersey	Illinois
		Madison	Illinois
		Monroe	Illinois
		St. Clair	Illinois
		Franklin	Missouri
		Jefferson	Missouri
		Lincoln	Missouri
		St. Charles	Missouri
		St. Louis	Missouri
		Warren	Missouri
		St. Louis	Missouri
Syracuse	Small	Cayuga	New York
		Madison	New York
		Onondaga	New York
		Oswego	New York
Tampa	Small	Hernando	Florida
		Hillsborough	Florida
		Pasco	Florida
		Pinellas	Florida

*Because LEHD data is not available for Connecticut, these counties are not included in the analysis, despite being a component of the Transit Region, as defined by the Center for Neighborhood Technology.

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15. Supplementary Notes FTA Project Contact: Jeff Price, Community Planner, Office of Systems Planning, 202-366-0843 or jeff.price@dot.gov			
16. Abstract (Limit: 200 words) This paper examines the composition of existing employment in areas served by fixed-guideway rail transit, and explores how industries vary in their proclivity to locate in higher density, transit-served locations. It also assesses which industries have experienced recent growth near transit in absolute numbers, even though they may have a declining share of total employment in transit areas. The outcome of this analysis is a better understanding of the types of industries that may have a greater propensity to be transit-oriented. Findings from this paper will be of interest to regional economic development planners working to build long-term structural capacity for economic growth. It will also be of interest to transit planners that seek to maximize regional employment access and achieve high levels of ridership. Policymakers and planners will be able to use this paper to identify which industries currently express the greatest affinity toward transit and, thus, may be most appropriate to target for recruitment or retention in transit-oriented locations. The findings of this paper may also be help to make more cost-effective transit investments to better serve transit-oriented businesses and their employees.			
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