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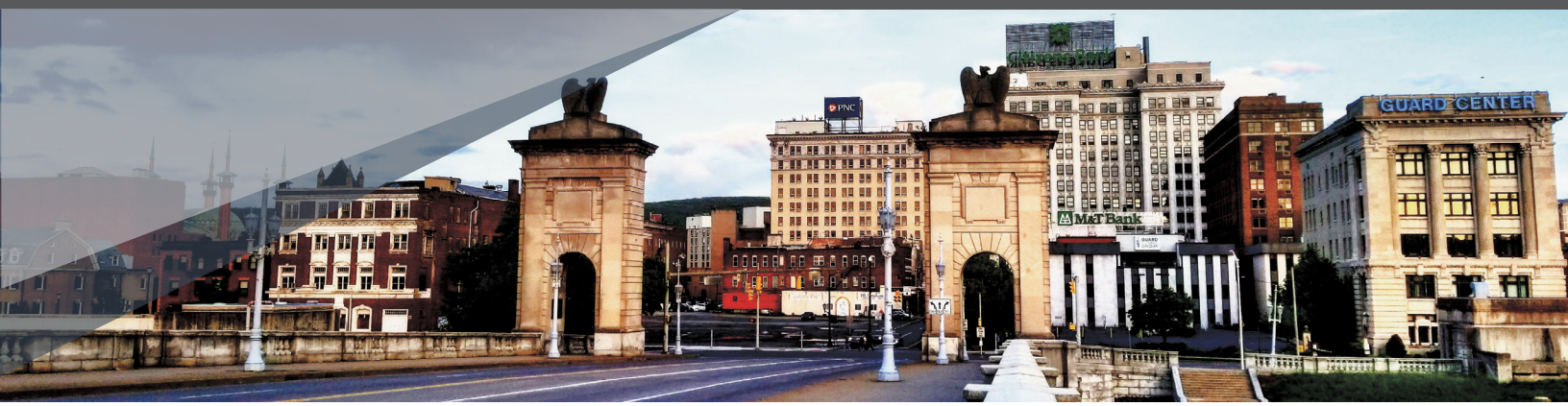

Getting to Work on Time

Public Transit and Job Access in Northeastern Pennsylvania

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ECONOMIC GROWTH & MOBILITY PROJECT

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Introduction

In early 2017, the Federal Reserve Bank of Philadelphia and the Scranton Area Community Foundation convened the Northeastern Pennsylvania Equitable Transit Planning Council, a group that has grown to include more than 50 local leaders representing transit agencies, planning organizations, health-care providers, nonprofits, philanthropy, and the private sector. Their vision was to "enhance the quality of life for residents of the northeastern Pennsylvania community by improving equitable access to transportation."[1] Anecdotally, regional leaders were aware of the challenges low-income families without a car faced in accessing important destinations, such as health-care facilities and retail locations. Recent qualitative research sheds light on these challenges. Residents without a car expressed frustration at being unable to get around, and these challenges particularly manifested themselves in the process of applying for and retaining employment. Moreover, several respondents expressed that good jobs found in the business and industrial parks located outside the central cities were difficult to access using transit.[2] To the extent that residents cannot commute to decent-paying jobs that match their skill levels, regional economic growth may be suppressed.

The role of public transit in fostering positive employment outcomes and regional economic growth is increasingly documented in economic research.[3] A study of the economic impact of bus transit among counties in the Great Lakes region found that the unemployment rate was significantly lower, employment growth was significantly greater, and real growth in food stamps payments was significantly less in counties with a bus transit system.[4] A subsequent study examined employee turnover rates across counties in Rust Belt states and found that larger bus transit systems, as measured by real per capita operating expenditures, were associated with lower employee turnover rates, suggesting better employee-employer matching and less employee absenteeism.[5]

Previous research noted the presence of transit challenges in Lackawanna and Luzerne counties but found that most important regional destinations are proximal to existing bus routes.[6] This study expands previous research by obtaining neighborhood-level estimates of transit and job access in Lackawanna and Luzerne counties. Public transit considered in this report includes bus transit provided by the region's three transit agencies: the County of Lackawanna Transit System (COLTS), the Luzerne County Transportation Authority (LCTA), and Hazleton Public Transit (HPT). This study answers the following questions:

1. Where is employment located in northeastern Pennsylvania?
2. Are bus stops located near where people live and work?
3. What percent of the region's jobs are accessible by transit in a reasonable amount of time?
4. How do proximity to transit and job access vary by neighborhood income?

Opportunity Employment

Having reliable transportation to work is only as valuable as having the skills needed to apply for and obtain a job. In the Scranton–Wilkes-Barre–Hazleton metro area, the unemployment rate for those with only a high school diploma or equivalent (7.6 percent) is much higher than the rate for those with at least a four-year degree (2.5 percent). Those who have not completed a high school education (13.5 percent) fare even worse in the job market.[7] Recognizing that not all jobs are available to someone without a four-year degree, I focus on jobs for which these residents can realistically compete and refer to these jobs as "opportunity employment."[8] Opportunity employment is defined

[1] Laura Ducceschi and Erin Mierzwa, "The Role of Transportation in Fostering Economic Mobility in Northeastern Pennsylvania," *Cascade*, 97 (Fall 2017); available at https://www.philadelphiafed.org/community-development/publications/cascade/97/01_the-role-of-transportation-in-fostering-economic-mobility-in-ne-pa.

[2] The Institute for Public Policy & Economic Development at Wilkes University, "Northeast Pennsylvania Equitable Transit Study," October 2017; available at https://www.philadelphiafed.org/-/media/community-development/publications/special-reports/northeastern-pennsylvania-equitable-transit-study/northeastern-pennsylvania-equitable-transit-study.pdf?la=en.

[3] For an expanded discussion of the relationship between transit and economic growth, see Brett Barkley, "The Role of Equitable Transit-Oriented Development in Promoting Economic Opportunity," *Cascade*, 97 (Fall 2017).

[4] Dagney Faulk and Michael Hicks, "The Economic Effects of Bus Transit in Small Cities," *Public Finance Review* 38, no. 5 (2010).

[5] Dagney Faulk and Michael Hicks, "The Impact of Bus Transit on Employee Turnover: Evidence from Quasi-Experimental Samples," *Urban Studies* 53, no. 9 (2016).

[6] The Institute for Public Policy & Economic Development, "An Analysis of Public Transit Demand in Lackawanna and Luzerne Counties," 2017; available at http://www.institutepa.org/PDF/Indicators/2017/publictransitdemand.pdf.

[7] 2016 American Community Survey (ACS) one-year estimates. The Scranton–Wilkes-Barre–Hazleton metropolitan statistical area includes Lackawanna, Luzerne, and Wyoming counties. However, in this report, when the metro area is not directly referenced, statistics for the region refer to only Lackawanna and Luzerne counties.

[8] The concept of opportunity employment is analogous to that of opportunity occupations introduced in Keith Wardrip, Kyle Fee, Lisa Nelson, and Stuart Andreason, "Identifying Opportunity Occupations in the Nation's Largest Metropolitan Economies." Federal Reserve Banks of Philadelphia, Cleveland, and Atlanta, September 2015; available at https://www.philadelphiafed.org/-/media/community-development/publications/special-reports/identifying_opportunity_occupations/identifying_opportunity_occupations_report.pdf?la=en.

here as employment that pays above the national annual median wage, adjusted for local price levels, for workers without a four-year degree. In the Scranton–Wilkes-Barre–Hazleton metro area in 2015, opportunity employment paid at least $33,304 annually. For a full discussion of the methods and data used in this analysis, see the appendix.

Table 1 presents the quantity of opportunity employment by industry for Lackawanna and Luzerne counties and the percent of total industry employment that qualifies as opportunity employment. In the two-county region, opportunity employment is greatest in manufacturing, transportation and warehousing, and health care and social assistance. The industries with the greatest opportunity employment shares, although not necessarily the greatest number of jobs, include mining, quarrying, and oil and gas extraction (55 percent); construction (46 percent); and transportation and warehousing (44 percent).

Figure 1 depicts the estimated location of opportunity and other employment in Lackawanna and Luzerne counties.[9] Opportunity and other employment are concentrated in the cities of Scranton, Wilkes-Barre, and Hazleton. Previous research found that in 2010, the metro area was notable among smaller regions (<500,000 jobs) in that it had one of the highest percentages of jobs located within three miles of downtown Scranton and Wilkes-Barre (46.5 percent).[10] However, prior research also found that in the years leading up to 2010, job growth had occurred outside Scranton and Wilkes-Barre, three to 10 miles from their central business districts.[11] Both patterns are visible in the map. Although clustered in the cities, opportunity and other employment centers are apparent in the Pittston area between Scranton and Wilkes-Barre, by the Geisinger Wyoming Valley Medical Center east of Wilkes-Barre, in Mountain Top south of Wilkes-Barre, near the Laurel Mall northwest of Hazleton, and in the Humboldt Industrial Park west of Hazleton.

Table 1. Opportunity Employment by Industry in Lackawanna and Luzerne Counties

Industry	Opportunity Employment	Total Employment	Opportunity Employment Share
Manufacturing	8,896	24,085	37%
Transportation and Warehousing	7,180	16,349	44%
Health Care and Social Assistance	7,148	41,273	17%
Retail Trade	6,181	26,662	23%
Construction	3,707	8,053	46%
Wholesale Trade	3,567	10,491	34%
Administrative and Support and Waste Management and Remediation Services	3,324	14,765	23%
Public Administration	2,736	7,263	38%
Accommodation and Food Services	2,278	17,763	13%
Finance and Insurance	1,921	10,507	18%
Other Services (Except Public Administration)	1,491	5,901	25%
Information	1,201	4,262	28%
Professional, Scientific, and Technical Services	1,108	7,373	15%
Utilities	1,085	2,515	43%
Educational Services	1,022	17,496	6%
Management of Companies and Enterprises	512	3,061	17%
Real Estate and Rental and Leasing	438	1,542	28%
Mining, Quarrying, and Oil and Gas Extraction	300	544	55%
Arts, Entertainment, and Recreation	298	1,857	16%
Agriculture, Forestry, Fishing and Hunting	24	163	15%
Total	**54,419**	**221,925**	**25%**

Note: The opportunity employment shares are calculated for workers in Pennsylvania and are used to estimate the quantity of opportunity employment in Lackawanna and Luzerne counties. These employment counts correspond to primary jobs, which, for a worker with more than one job, refers to the job that generates the highest wages. For comparison, there are a total of 238,721 jobs in the region, of which 221,925 (93 percent) are primary jobs. Opportunity employment estimates by industry do not sum to total because of rounding.

Sources: Author's calculations using 2011–2015 American Community Survey (ACS) Public Use Microdata Sample (PUMS) 5-Year Estimates, Bureau of Economic Analysis (BEA) Regional Price Parities (RPPs) (2011–2015), and Longitudinal Employer-Household Dynamics Origin-Destination Statistics (LEHD LODES) (2015).

Time of Arrival at Work

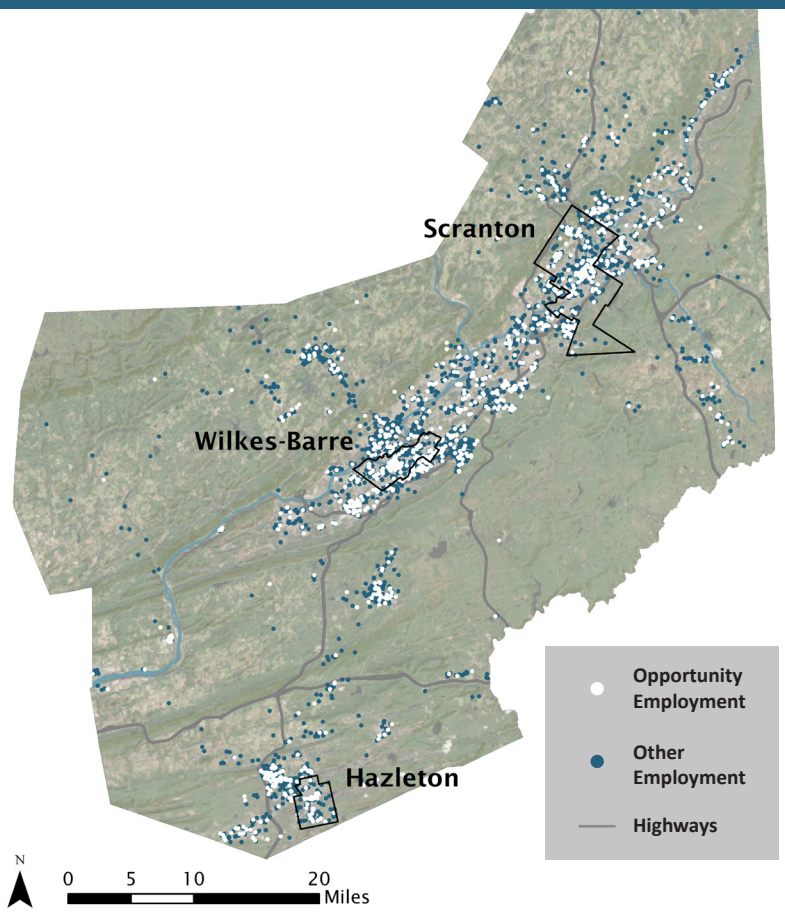
Not all employees have the same work schedule, and bus service is not consistent across all hours of the day and days of the week. In order to perform an analysis of job access using tran-

[9] "Other employment" is simply calculated as the total number of jobs in a census block that are not classified as opportunity employment. Together, opportunity and other employment sum to total employment for each industry in every census block.

[10] Elizabeth Kneebone, "Job Sprawl Stalls: The Great Recession and Metropolitan Employment Location," The Brookings Institution Metropolitan Policy Program, April 2013; available at https://www.brookings.edu/wp-content/uploads/2016/06/Srvy_JobSprawl.pdf.

[11] Elizabeth Kneebone, "Job Sprawl Revisited: The Changing Geography of Metropolitan Employment," The Brookings Institution Metropolitan Policy Program, April 2009; available at https://www.brookings.edu/wp-content/uploads/2016/06/20090406_jobsprawl_kneebone.pdf; The Institute for Public Policy & Economic Development at Wilkes University, "Job Sprawl in Northeast Pennsylvania: A Rebuttal of the Brookings Institution Report on Job Sprawl Revisited," September 2009; available at http://www.institutepa.org/PDF/Research/jobsprawl0809.pdf.

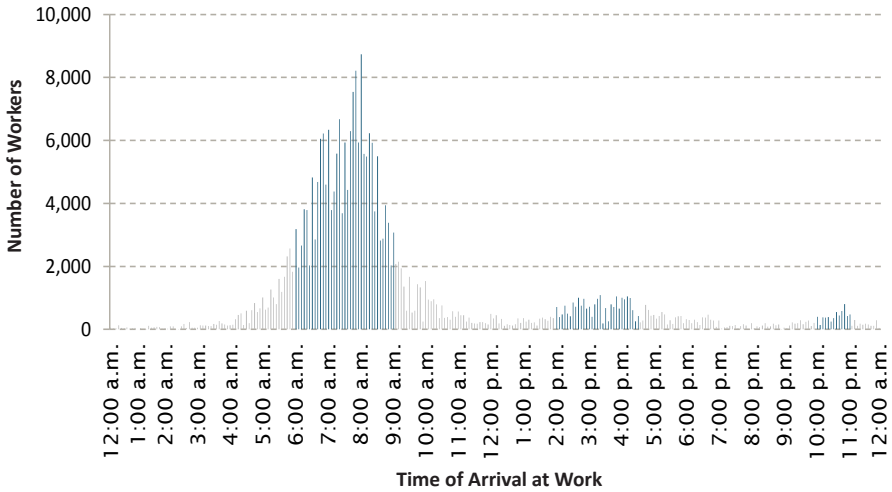
Figure 1. Location of Opportunity and Other Employment



Note: One dot represents 35 jobs. Dots do not represent the actual location of employment; rather, they reflect job density within census blocks.

Sources: Author's calculations using data obtained from ACS PUMS (2011–2015), BEA RPPs (2011–2015), LEHD LODES (2015), U.S. Census TIGER/Line Shapefiles, Pennsylvania Department of Transportation (PennDOT), and ESRI.

Figure 2. Time of Arrival at Work in Northeastern Pennsylvania



Source: Author's calculations using ACS PUMS (2011–2015). Estimates include Lackawanna, Luzerne, Wyoming, and Columbia counties.

sit that is aligned with workers' schedules, I explored the distribution of times at which workers in northeastern Pennsylvania arrive at work (Figure 2). The distribution shows that 63 percent of employees arrive at work between 6:00 a.m. and 9:00 a.m. Two additional peaks in the distribution correspond to the start of second and third shifts between 2:00 p.m. and 4:30 p.m. and 10:00 p.m. and 11:00 p.m., respectively. In the proximity and job access analyses that follow, I only use bus trips (and all associated stops) for which at least one of those stops is made between 6:00 a.m. and 9:00 a.m. on the typical weekday.

Living and Working in Proximity to Transit

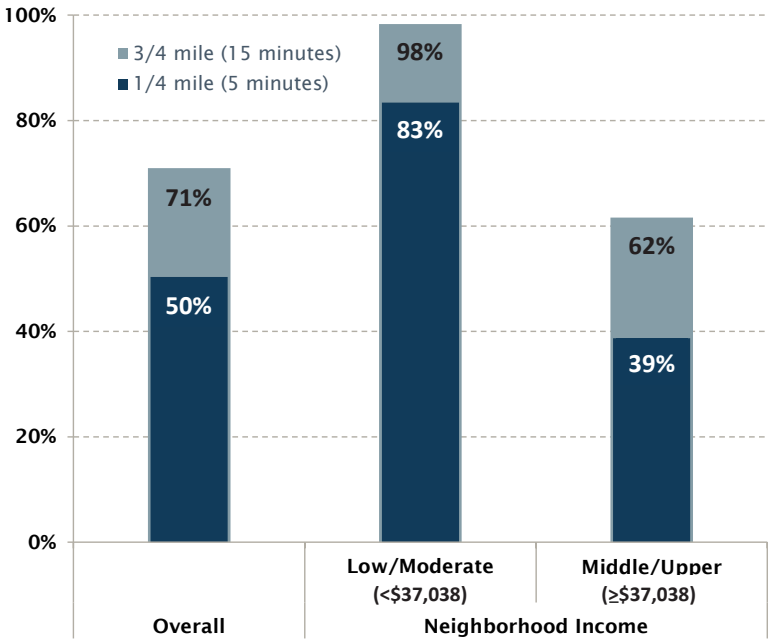
To quantify the percentage of the population and the share of jobs in close proximity to transit, I calculated the walking distance between each census block and the nearest bus stop.[12] A collection of census blocks forms a census block group, which is hereafter referred to as a neighborhood.[13] A neighborhood is considered to be **conveniently located near transit** if at least 50 percent of residents living in constituent census blocks live within one-quarter of a mile of a bus stop. A neighborhood is considered to be **accessible to transit** if the majority of residents live within three-quarters of a mile of a bus stop. These distances translate into a five-minute and a 15-minute walking time, respectively, assuming a reasonable pace of three miles per hour.

Half (50 percent) of residents in Lackawanna and Luzerne counties live in neighborhoods conveniently located near transit, and a distinct majority (71 percent) live in neighborhoods with access to transit (Figure 3). A much greater share of residents in low- and moderate-income (LMI) neighborhoods lives conveniently near transit (83 percent) and has access to transit (98 percent); these

[12] To enhance the reality of the analysis, I prohibited pedestrian travel along large highways such as I-81 and the Pennsylvania Turnpike.

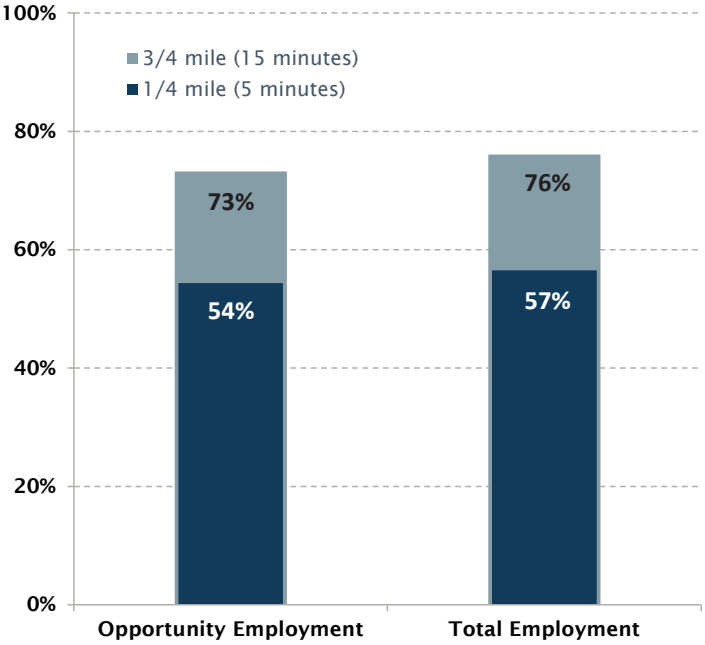
[13] In urbanized areas, census blocks are the size of actual neighborhood blocks but are larger in more rural locations.

Figure 3. Percent of Residents Living Within Walking Distance of a Bus Stop



Sources: Author's calculations using data obtained from County of Lackawanna Transit System (COLTS), Hazleton Public Transit (HPT), Center for Neighborhood Technology (CNT), Open Street Map (OSM), ACS PUMS (2011–2015), BEA RPPs (2011–2015), and LEHD LODES (2015).

Figure 4. Percent of Jobs Within Walking Distance of a Bus Stop



Sources: Author's calculations using data obtained from COLTS, HPT, CNT, OSM, ACS PUMS (2011–2015), BEA RPPs (2011–2015), and LEHD LODES (2015).

neighborhoods are typically located in the urban core, where transit service is greatest.[14,15]

Applying the same proximity analysis to the location of jobs in the region, I find that opportunity employment is slightly less accessible by transit than employment overall. About 54 percent of opportunity employment and 57 percent of total employment are conveniently located near a bus stop. The percentage of jobs accessible by transit rises to 73 percent for opportunity employment and 76 percent for total employment (Figure 4). The similar percentages for opportunity and total employment confirm the pattern exhibited on the map — that the geographic distributions of opportunity and other employment are similar. Still, more than one-quarter of opportunity employment (27 percent) is not accessible by transit.

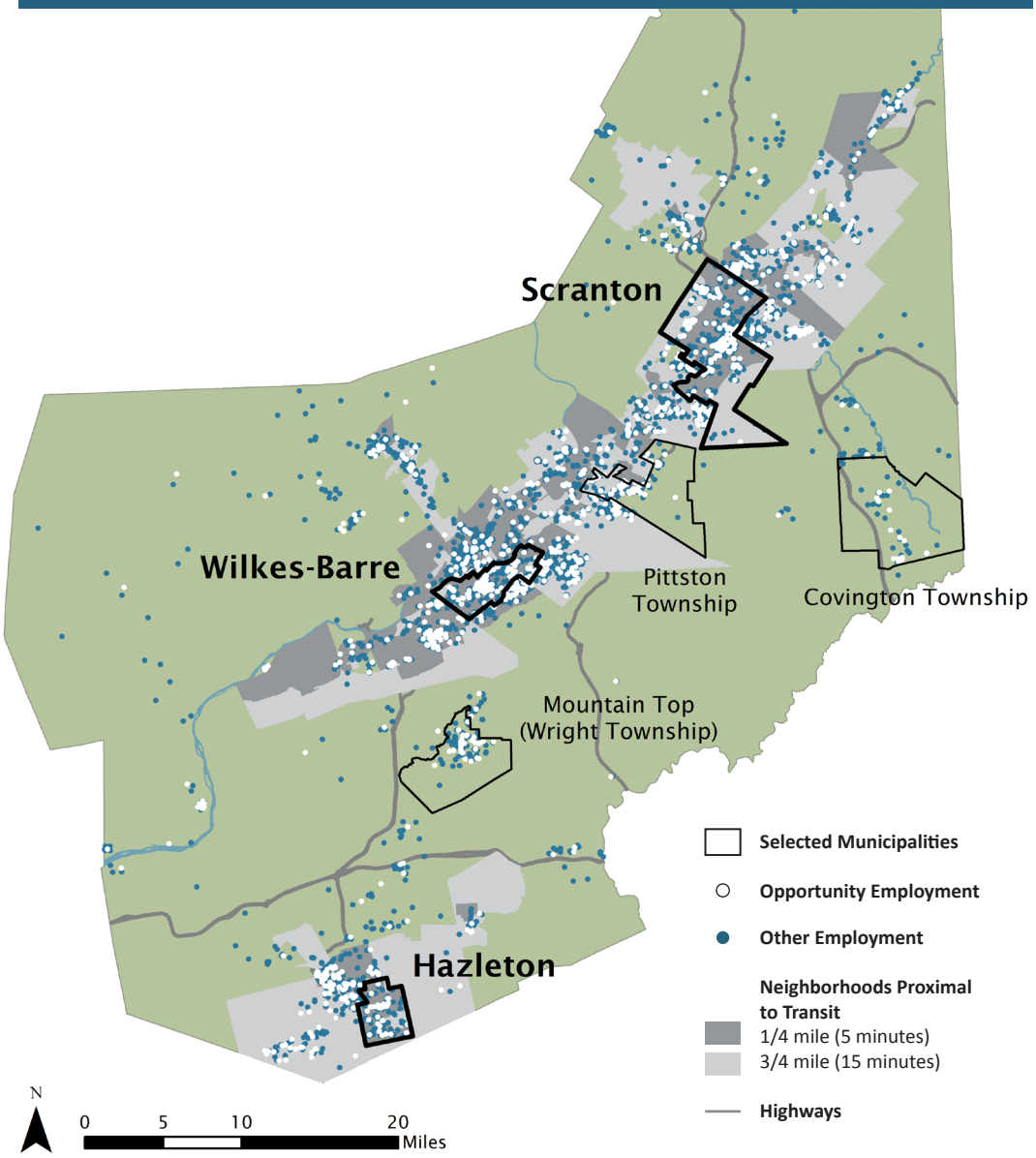
Figure 5 depicts the location of employment relative to neighborhoods that have access to transit. Access to transit is strongest in downtown Scranton, Wilkes-Barre, and Hazleton. Access to transit thins between Scranton and Wilkes-Barre, where one job center, largely represented by the CenterPoint Commerce and Trade Park in Pittston Township, lies immediately outside the transit access zone. Other similar areas exist in the region, such as Mountain Top south of Wilkes-Barre and Covington Township southeast of Scranton. It is important to note that bus service does extend from Hazleton to Mountain Top on the way to Wilkes-Barre; however, it is only offered twice daily, and less than half of Mountain Top residents live in census blocks within a 15-minute walk of a bus stop.

The results of the proximity analysis reveal that most people have access to transit, and most jobs are accessible by transit. Importantly, access to transit is even greater in LMI neighborhoods. These findings

[14] LMI neighborhoods had a 2015 median household income below $37,038, which corresponds to 80 percent of the 2015 median household income in the Scranton–Wilkes-Barre–Hazleton metro area ($46,298 using 2011–2015 ACS data). While the results are not included in this report, I performed a similar analysis for neighborhoods in the bottom quartile for household car access and neighborhoods in the bottom quartile for four-year degree attainment and found similarly high rates of transit access.

[15] Despite a number of methodological differences, prior research reached very similar conclusions regarding the share of total residents (73 percent) and residents in LMI neighborhoods (99 percent) with access to transit. See Adie Tomer, Elizabeth Kneebone, Robert Puentes, and Alan Berube, "Missed Opportunity: Transit and Jobs in Metropolitan America," The Brookings Institution Metropolitan Policy Program, May 2011; available at https://www.brookings.edu/wp-content/uploads/2016/06/0512_jobs_transit.pdf.

Figure 5. Neighborhood Proximity to Transit and the Location of Employment



Note: One dot represents 35 jobs. Dots do not represent the actual location of employment; rather, they reflect job density within census blocks.

Sources: Author's calculations using data obtained from COLTS, HPT, CNT, OSM, ACS PUMS (2011–2015), BEA RPPs (2011–2015), LEHD LODES (2015), U.S. Census TIGER/Line Shapefiles, and PennDOT.

are predicated on the assumption that residents are able to walk three-quarters of a mile from home or work to a bus stop; for those with physical mobility challenges, access to transit is more limited. In addition, roughly one-fourth of the region's jobs, including a few identifiable job centers of note, are inaccessible by transit.

Job Access and the Public Transit Network

This research has shown that the majority of residents in Lackawanna and Luzerne counties live within a convenient walk of at least one bus stop, and the majority of jobs are located within a convenient walk of a bus stop. But what share of jobs can the typical resident actually reach by bus in a reasonable amount of time? To answer this question, for every neighborhood in Lackawanna and Luzerne counties, I calculated the number of jobs a person can reach in 60 minutes during the morning commute window, allocating no more than 20 minutes of that time for walking. The median neighborhood in Lackawanna and Luzerne counties can access 12 percent of opportunity employment during the morning commute window.[16] Access to opportunity employment ranges from 0 percent to 40 percent across neighborhoods in the region.

It should not be surprising that the share of opportunity employment accessible from the typical neighborhood (12 percent) is markedly lower than the share of opportunity employment that is proximal to at least one bus stop (73 percent). First, one cannot expect to be able to access all jobs in Lackawanna and Luzerne counties within 60 minutes. Wilkes-Barre and Hazleton are approximately 45 minutes apart by car, and Scranton and Hazleton are approximately one hour apart by car. After incorporating the additional time needed for transferring between buses and walking, Hazleton lies outside the 60-minute commute zone for Scranton and Wilkes-Barre, and vice versa. Second, the current transit systems are largely radial in design,

[16] Despite their different methodological approach, Tomer et al. (2011) produced similar findings for the share of employment accessible, on average, from neighborhoods with transit access in the Scranton–Wilkes-Barre metropolitan area (12.3 percent) and in similarly-sized Pennsylvania metro areas including the Allentown–Bethlehem–Easton (12.2 percent) and Harrisburg–Carlisle (16.6 percent) metro areas.

with the majority of trips originating or terminating at each city's respective transit center. In certain cases, routes pass through a centrally located transit station before traveling outbound to a job center, which can extend commute times beyond the 60-minute limit used in this analysis.

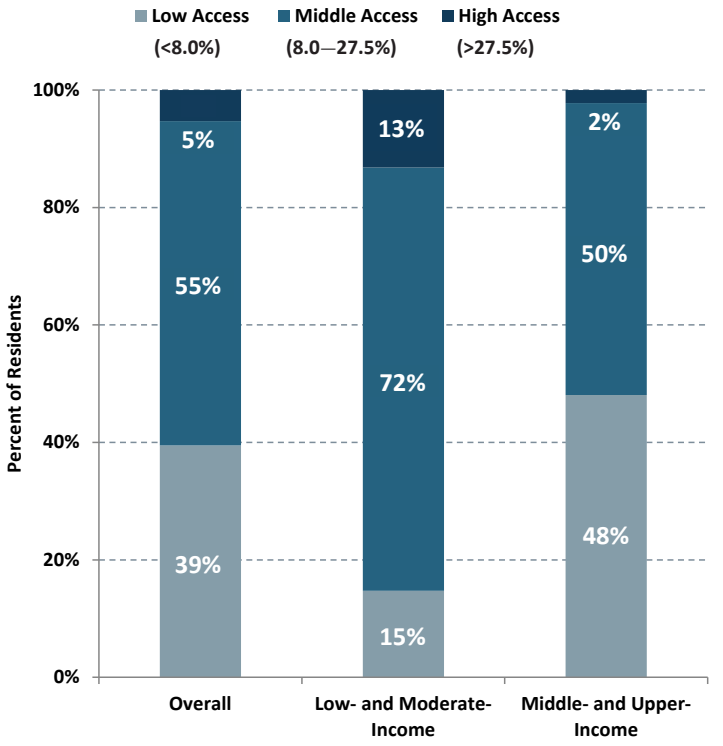
How does job access vary by neighborhood income? To answer this question, I classified neighborhoods based on the share of regional opportunity employment that residents can reach by transit: low access (less than 8.0 percent of opportunity employment), middle access (8.0—27.5 percent), and high access (greater than 27.5 percent), as shown in Figure 6. Residents of LMI neighborhoods generally have greater job access using transit. Whereas 39 percent of residents overall are in low-access neighborhoods, only 15 percent of residents in LMI neighborhoods have low access. In addition, the percent of residents in LMI neighborhoods with high job access (13 percent) is greater than the percent of residents overall with high access (5 percent).

From a transit equity perspective, the location of LMI neighborhoods with low job access suggests places where transit service might be improved (Figure 7). A number of these places are located on the periphery of Scranton (e.g., Carbondale) and Wilkes-Barre (e.g., Nanticoke). Several others are clustered around Hazleton; as noted previously, Hazleton generally lies outside a 60-minute commute to employment in Scranton and Wilkes-Barre, which explains why job access in these neighborhoods is suppressed.

Examining the neighborhoods with high job access reveals features of the transit network that enhance accessibility. Overall, job access is greatest in the neighborhoods immediately surrounding the Lackawanna Transit Center in Scranton and the Intermodal Transit Center in Wilkes-Barre. In addition, there are two other circumstances that are commonly associated with high levels of job accessibility. First, job access is high in specific places between Scranton and Wilkes-Barre, such as Pittston at the confluence of the COLTS and LCTA systems (Figure 8a). Having access to both bus systems allows transit riders access to job centers in both cities. Second, access is greatest in locations such as Kingston (Figure 8b), where two or more bus routes, traveling in divergent directions, connect residents to different parts of the city.

By focusing on the morning commute window, it is important to note that this analysis says little about the experience of those who work second and third shifts, overtime, or weekends. Most existing bus service in the region begins after 5:00 a.m. and completes by 7:00 p.m. during the week and is limited on weekends. Someone working second shift may be able to take a bus to work in the afternoon but would not be able to rely on transit for the return trip home. In similar fashion, someone working third shift would be unable to take a bus to work at night but may be able to take a bus home in the early hours of the following morning.

Figure 6. Percent of Residents by Neighborhood Income with Low, Middle, and High Access to Regional Opportunity Employment



Note: Overall percentages do not sum to 100% because of rounding.

Sources: Author's calculations using data obtained from COLTS, HPT, CNT, OSM, ACS PUMS (2011–2015), BEA RPPs (2011–2015), and LEHD LODES (2015).

Conclusion

For residents without access to a car in Lackawanna and Luzerne counties, transportation can be a formidable barrier to employment, hampering both an applicant's ability to apply for a job and an employed resident's ability to retain one. In this report, I use the concept of opportunity employment in order to estimate the location of decent-paying jobs for workers without a four-year degree. Rather than only looking at the proximity of bus stops to job centers, I use existing bus schedules and a reasonable commute time to analyze which jobs are accessible to residents in a given neighborhood and how this accessibility varies across neighborhoods. The following is a summary of findings:

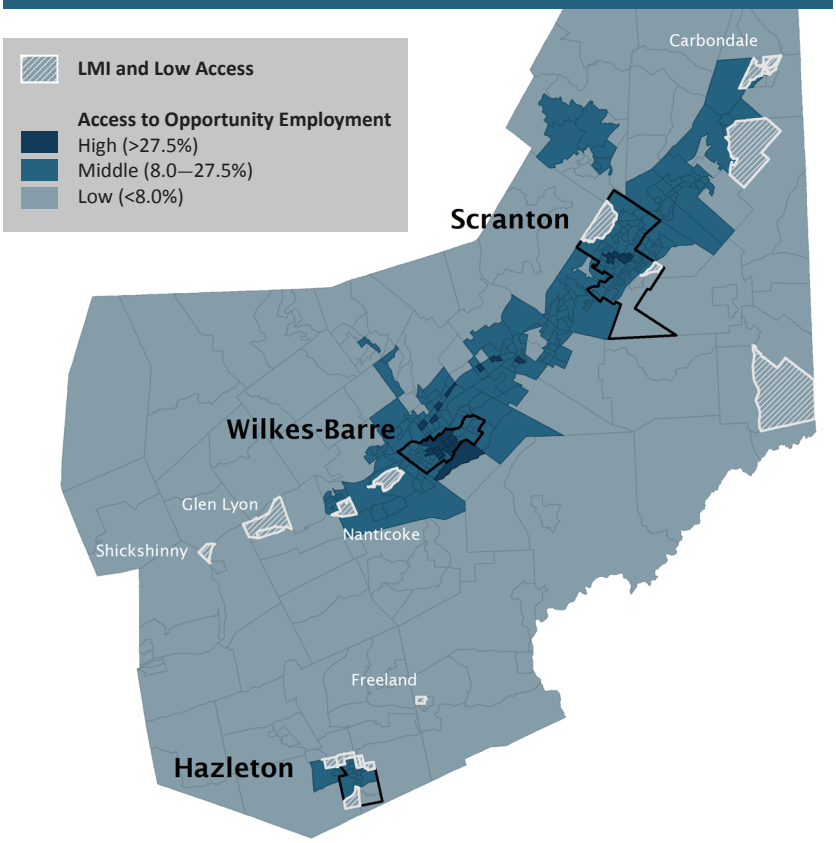
- The largest opportunity industries in Lackawanna and Luzerne counties are manufacturing, transportation and warehousing, and health care and social assistance. Employment is largely centralized in the cities of Scranton, Wilkes-Barre, and Hazleton, but important job centers exist outside of these cities in places not accessible by transit.
- Half of residents (50 percent) live in neighborhoods within

a five-minute walk of a bus stop, and 71 percent of residents live in neighborhoods within a 15-minute walk of a bus stop. Access is greater in LMI neighborhoods, where the vast majority of residents (83 percent) live in neighborhoods within a five-minute walk of a bus stop.

- The majority of jobs classified as opportunity employment (73 percent) are located within a 15-minute walk of a bus stop.
- In contrast to the share of jobs proximal to transit, job access is substantially reduced when considering the number of jobs a resident can access in a 60-minute commute. Residents of the median neighborhood can access only 12 percent of opportunity employment in the region.
- Job access is greater in LMI communities. The share of residents living in LMI neighborhoods with high job access (13 percent) is greater than the share of residents overall with high access (5 percent).
- LMI communities where job access is low (e.g., Carbondale, Nanticoke) represent opportunities for improving connections between prospective workers and regional job centers.
- Neighborhoods with high access to employment using transit are often situated in locations where residents can take advantage of both the COLTS and LCTA bus systems or in locations where two or more bus routes intersect and lead to different parts of town.

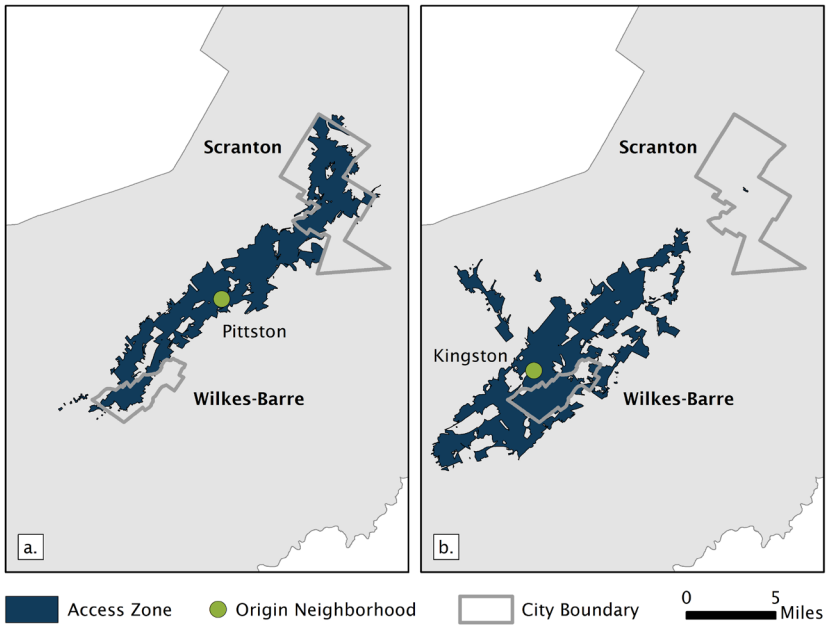
This report advances our understanding of how three public transit agencies contribute to a regional transportation system and link residents to jobs for which they can compete. Developing and maintaining public transit systems that maximize connections between low-income neighborhoods and employment opportunities is no small task, particularly where concerns about equitable access to transit are tempered by the need for financially sustainable service. Addressing the connectivity of low-income neighborhoods with low job access is one component of an equitable transportation strategy for the region. Looking forward, engagement between the public transit agencies and the private sector will be critical to ensuring that future public transit enhancements consider the location and accessibility of anticipated job growth in the region.

Figure 7. Neighborhood Access to Opportunity Employment



Sources: Author's calculations using data obtained from COLTS, HPT, CNT, OSM, ACS PUMS (2011–2015), BEA RPPs (2011–2015), LEHD LODES (2015), U.S. Census TIGER/Line Shapefiles, and PennDOT.

Figure 8. The 60-Minute Access Zone Surrounding Pittston (a) and Kingston (b)



Sources: Author's calculations using data obtained from COLTS, HPT, CNT, OSM, U.S. Census TIGER/Line Shapefiles, and PennDOT.

Appendix

Opportunity Employment and Total Employment

In order to determine the quantity of opportunity employment within each industry, I began with an analysis of the 2011–2015 American Community Survey (ACS) Public Use Microdata Sample (PUMS). This sample contains responses from approximately 5 percent of U.S. households and includes detailed fields on individuals' employment status, industry of employment, wages, hours worked per week, weeks worked per year, and educational attainment. I subsetted the sample to include only respondents between the ages of 16 and 40 employed in Pennsylvania who were not currently enrolled in school, worked 50–52 weeks in the past year, and worked 35–60 hours in a regular week. I restricted the age of respondents in the sample to ensure the estimate of opportunity employment was not upwardly biased by older workers who entered the workforce at a time when four-year degrees were not as prevalent and whose earnings reflected a lifetime's worth of experience. As a result, included respondents were more recent entrants to the labor force. Once the sample was restricted, I identified respondents (1) with less than a bachelor's degree and (2) earning more than the national annual median wage, adjusted for cost of living across metropolitan statistical areas. I performed cost of living adjustments using the Bureau of Economic Analysis's (BEA) 2011–2015 Regional Price Parities (RPPs) for metropolitan statistical areas and the nonmetropolitan portion of Pennsylvania.[17] For each industry, I calculated the share of workers meeting these criteria as a percentage of all workers in the industry.

In order to assess the spatial distribution of opportunity employment in the region, I multiplied each industry's opportunity employment share by the corresponding primary job count for each industry in every census block. Employment data are from the U.S. Census Bureau's Longitudinal Employer-Household Dynamics (LEHD) program's Origin-Destination Employment Statistics (LODES) dataset.[18] LEHD LODES draws from state unemployment insurance filings and federal government civilian employment records, and for a worker with multiple jobs, the primary job refers to the one that generates the highest wages.[19]

Transit and Road Files

In order to examine access to jobs using public transit, I used General Transit Feed Specification (GTFS) files for the three active transit agencies in the region: the County of Lackawanna Transit System (COLTS), the Luzerne County Transportation Authority (LCTA), and Hazleton Public Transit (HPT). A GTFS is a collection of files that together provides the full picture of routes, trips, stop times, stop locations, and days of operation of fixed-route transit services. I obtained a GTFS file from all three transit agencies but chose to use the agency-provided file only for COLTS and HPT; I used a GTFS file for LCTA that was created by the Center for Neighborhood Technology (CNT). The GTFS files used in this study reflect the bus networks as they existed in October 2017. The proximity and job access analyses only use bus trips (and all associated stops) where at least one of those stops is made between 6:00 a.m. and 9:00 a.m. on a typical weekday.

I incorporated Open Street Map (OSM) roads data to model road and pedestrian segments. The OSM data were downloaded on September 2, 2017.

Proximity Analysis

To calculate the percent of residents and jobs proximal to transit, I built a network dataset of road and pedestrian segments for Lackawanna and Luzerne counties. Using ESRI's ArcGIS Network Analyst extension, I calculated the network distance from each census block in the region to the nearest bus stop. If at least 50 percent of residents of census blocks within a census block group were within one-quarter of a mile of a bus stop, the census block group was considered to have **convenient** access to transit. Similarly, if at least 50 percent of residents of census blocks within a census block group were within three-quarters of a mile of a bus stop, the census block group was considered **accessible** to transit.

[17] U.S. Department of Commerce Bureau of Economic Analysis, "Real Personal Income for States and Metropolitan Areas, 2015," news release, June 22, 2017, available at https://www.bea.gov/newsreleases/regional/rpp/rpp_newsrelease.htm.

[18] U.S. Census Bureau. *2015 LEHD Origin-Destination Employment Statistics Data (LODES 7.3)* (Washington, Census Bureau), https://lehd.ces.census.gov/data/#lodes.

[19] It is impossible to distinguish between full-time and part-time jobs in the LEHD LODES data set. As a result, this analysis may overstate opportunity employment because the opportunity employment shares are based on an analysis of full-time workers. These shares are applied to all primary jobs, some of which are not full-time jobs.

Job Access

To measure job access, I built a multimodal network data set of transit, road, and pedestrian segments. I employed the "Add GTFS to a Network Dataset" toolbox, developed by ESRI engineer Melinda Morang, to bring the GTFS files into the ArcGIS environment and to incorporate them into the network dataset.[20] Using the network dataset and the Network Analyst extension, I calculated an origin-destination cost matrix (OD cost matrix), which reported the fastest commute time between each census block group (origin) and census block (destination) in the two-county region. The OD cost matrix also reported for each commute time the amount of time spent walking. In this model, pedestrians were not able to walk along motorways such as the Pennsylvania Turnpike or I-81. I assumed a reasonable walking speed of three miles per hour, and a special transit evaluator developed by Melinda Morang enabled the model to read bus schedules and make routing decisions accordingly. Because bus service is variable across the course of the day, I ran the OD cost matrix analysis every five minutes between 6:00 a.m. and 8:00 a.m. on October 17, 2017, representing a typical weekday morning. Next, I compiled the resulting 25 matrices into a single file and selected the quickest time for each origin-destination pair, eliminating those with a commute time greater than 60 minutes or a walk time greater than 20 minutes. The resulting file portrays, for each census block group (origin), a 60-minute transit access zone within which a person could travel using transit and arrive at work no later than 9:00 a.m., the end of the morning commute window.

[20] The toolbox and helpful supporting documentation are available at http://esri.github.io/public-transit-tools/AddGTFStoaNetworkDataset.html.

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