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Opportunities for Youngstown in the Supply Chains of Northeast Ohio and Pittsburgh Economies

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OPPORTUNITIES FOR YOUNGSTOWN IN THE SUPPLY CHAINS OF NORTHEAST OHIO AND PITTSBURGH ECONOMIES

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ACKNOWLEDGMENTS

ABOUT THIS RESEARCH

In this study, the Youngstown region in Ohio is represented by two counties on the eastern end of the state: Mahoning and Trumbull. Historically, this region has specialized strongly in metal and automotive manufacturing and now represents 8% of Northeast Ohio[1] (16-county NEO) employment and 6% of its output. Recently, the region has endured several blows to its employment and productivity. The closure of the Lordstown GM plant in 2019 left 1,500 people unemployed and just a year later, about 40% of employed residents found themselves filing for unemployment during the COVID-19 pandemic.[2] Despite these struggles, Youngstown has a privileged location as part of NEO, set in between the Cleveland-Elyria Metropolitan Statistical Area[3] (Cleveland MSA), and the Pittsburgh Metropolitan Statistical Area[4] (Pittsburgh MSA) where it can expand economic ties and create more opportunities for its residents (Figure 1).

The Center for Economic Development at Cleveland State University conducted this analysis to determine opportunities for the Youngstown economy in the supply chains of Northeast Ohio and Pittsburgh economies. This research report has three main parts. The first section presents the economic base industries in regions neighboring Youngstown. The second section details the economic base and aspirational industries in Mahoning and Trumbull counties. The third section discusses how Youngstown can find its economic prosperity by servicing neighboring regions. The appendix provides detailed tables on NEO's and Pittsburgh's supply chains interlaid with economic base and aspirational industries in Youngstown.

Key Findings

> The economic bases of the 16-county NEO region and the Youngstown region (Mahoning and Trumbull counties) are dominated by manufacturing, particularly Metal Manufacturing.

> The Pittsburgh MSA has a more diversified economic base, with Service industries contributing most to employment and output.

> The economic bases of the 16-county NEO region and the Pittsburgh MSA had the highest demand for inputs in five sectors: Advanced Manufacturing, Other Manufacturing, Financial Services, Energy, and Polymers & Chemicals.

> Youngstown can account for a greater share of input purchases from the NEO and Pittsburgh regions by focusing on *Nonferrous Metal (Except Aluminum) Production and Processing, Alumina and Aluminum Production and Processing,* and *Plastic Product Manufacturing*.

> Youngstown has the potential to develop its economic ties with Pittsburgh's economy in its aspirational sector – Financial Services.

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[1] 16-county NEO region is Northeast Ohio excluding 2 counties of the Ohio's part of the Youngstown MSA. This region includes Ashland, Ashtabula, Columbiana, Cuyahoga, Erie, Geauga, Huron, Lake, Lorain, Medina, Portage, Richland, Stark, Summit, Tuscarawas, and Wayne counties.

[2] Demko, I., Lendel, I., Piazza, M., Figueroa, G., Ellerbrock, M. (2020). Youngstown Economy: Recession and Path to Recovery. *Urban Publications*.

[3] Cleveland-Elyria Metropolitan Statistical Area includes Cuyahoga, Geauga, Lake, Lorain, and Medina counties.

[4] Pittsburgh Metropolitan Statistical Area includes Allegheny, Armstrong, Beaver, Butler, Fayette, Washington, and Westmoreland Counties.

Figure 1. Area of Study
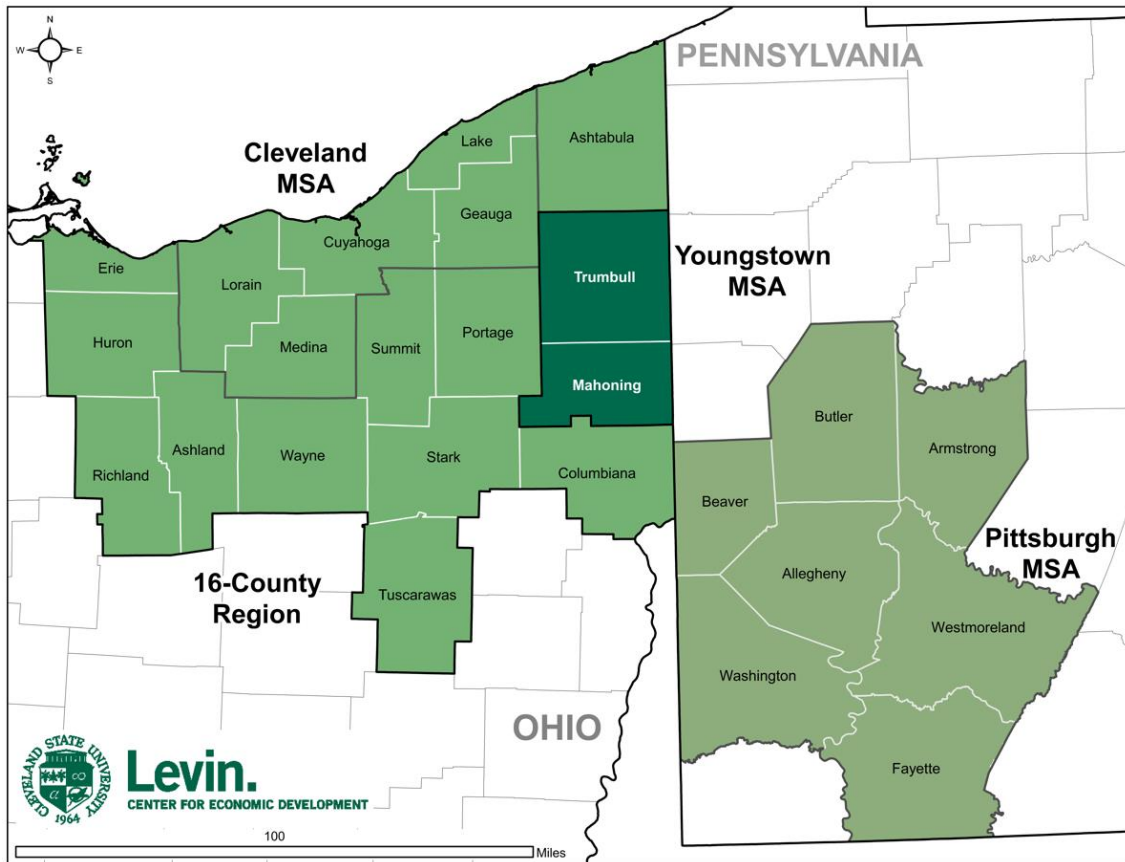
SECTION I. ECONOMIC BASE INDUSTRIES

The economic base of each region was determined using Location Quotients (LQ), a statistical tool that helps define the specialization level that industry has in one region compared to the size/share of the industry at the national level.[5] An LQ of 1.0 means that the region and the nation are equally specialized in that industry; an LQ less than one indicates that the regional specialization in the industry is below the national average; while an LQ greater than one indicates that the regional economy has higher concentration of employment or output in a particular industry compared to the national average. The higher specialization approximates export of the industry's product and identifies this industry as a part of the regional economic base. Using Moody's Analytics data, we performed LQ analysis on three regions neighboring Mahoning and Trumbull counties: 16-county Northeast Ohio, the Cleveland MSA, and the Pittsburgh MSA (Figure 1). Those industries that presented an LQ higher than 1.2[6] were counted in the economic base of each region.[7]

16-County Northeast Ohio Region

Northeast Ohio's economy represents 35% of the state's output and employment. The region has shown an upward trend and presented output growth of over 3% since 2017, and it's expected to have a faster recovery from the COVID pandemic than other regions in the state of Ohio.[8] We found that the economic base in the 16-county NEO region is dominated by manufacturing industries which represent over 9% of the region's output and support 6% of regional employment (Figure 2). The region specializes in Metal Manufacturing representing 47% of the economic base's employment and 33% of its output, followed by other manufacturing industries such as Machinery Manufacturing and Chemical Manufacturing (Figure 2).

Figure 2. Industrial Composition of Economic Base in 16-County NEO Region

Prepared by the Center for Economic Development using 2020 Moody's Analytics Data

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[5] Bureau of Economic Analysis. (2008, January 11). What are Location Quotients?

[6] This higher LQ ensures the research is not reflecting noisy data.

[7] We removed population service industries and government from the analysis as these are necessary for the operation of any economy.

[8] Vanac, M. (2021, March 22). NE Ohio added more jobs, payroll in 2020 than other state regions. *Cleveland Business Journal*

Figure 3 shows NEO's economic base industries, their employment specialization measured by LQ, and their percent change in output from 2017 to 2019. The region has a strong manufacturing presence with many industries related to advanced manufacturing having large employment concentration compared to national averages. *Paint, Coating, and Adhesive Manufacturing* had the highest employment specialization (LQ = 6) supporting 4,840 jobs in 2020. The Sherwin-Williams Company, a global leader in paints and coatings, is the major employer in this industry. *Agriculture, Construction, and Mining Machinery Manufacturing* (LQ=1.4) and *Resin, Synthetic Rubber, and Artificial and Synthetic Fiber and Filament Manufacturing* (LQ=2.5) showed the highest output growth (25%) between 2017 and 2019. Industries with high specialization and a significant number of jobs include *Other General Purpose Machinery Manufacturing (LQ=3.7) Other Fabricated Metal Product Manufacturing* (LQ=3.1) and *Machine Shops; Turned Product; and Screw, Nut, and Bolt Manufacturing* (LQ=2.8), each of them supports over 10,000 jobs.

Figure 3. 16-County NEO Region Economic Base Industries
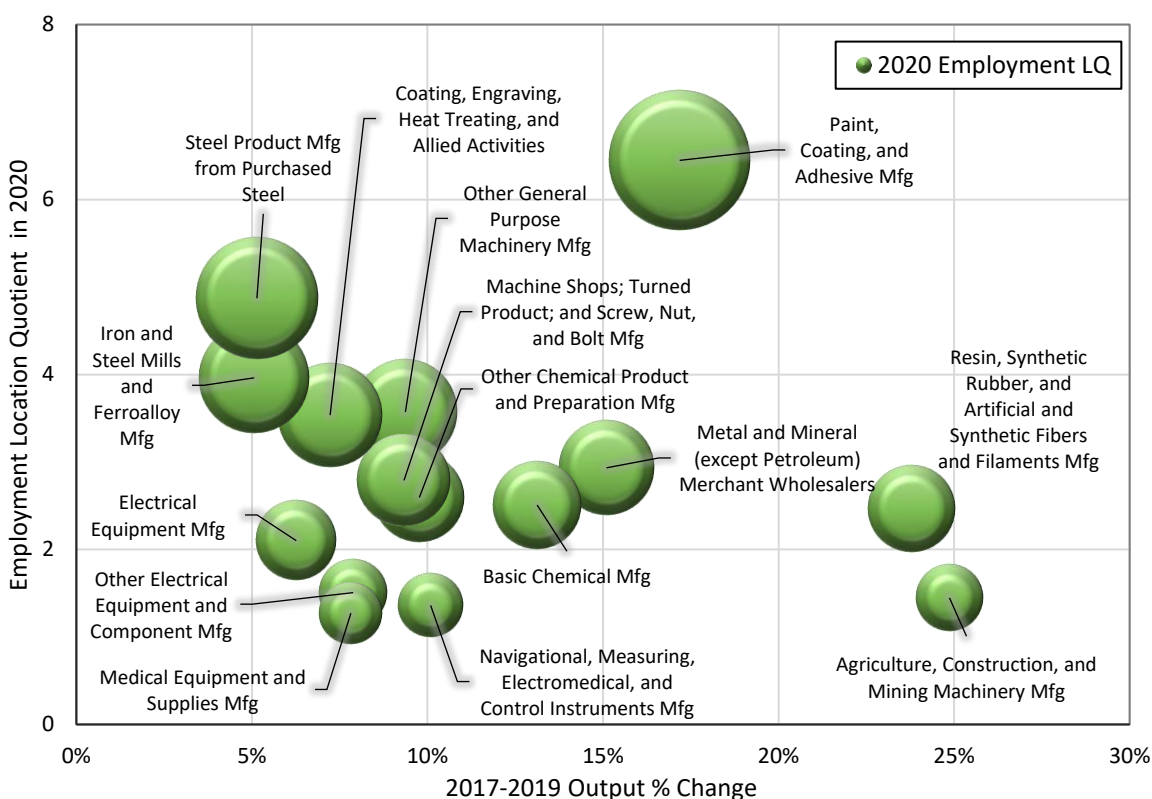
Note: Figure 3 shows Top 15 producing industries of a total of 23 industries in NEO's economic base
Prepared by the Center for Economic Development using Moody's Analytics Data

Cleveland MSA

The Cleveland MSA's economic base has a similar composition to the NEO region's given the large presence of manufacturing industries. These industries combined supported about 130,000 jobs in the Cleveland MSA (13% of total employment) and contributed 9% to the region's output. A quarter of the economic base industries in the Cleveland MSA are related to Metal Manufacturing industries (Fabricated Metal Manufacturing and Primary Metal Manufacturing), which represent

21% of the economic base industry's employment and 15% of its output. Mirroring the NEO region, both Chemical and Machinery Manufacturing contribute significantly to employment and output.

Pittsburgh MSA

The Pittsburgh MSA contributes 21% to Pennsylvania's output and 19% to the state employment. The region's economic base includes a diverse set of industries with the service sector representing the largest share of employment and output, 68% (Figure 4). In 2020, the 24 industries in the economic base generated over 140,000 jobs (13% of total employment) and comprised 17% of the region's output. Metal Manufacturing contributed 13% to the economic base employment and output; Oil and Gas, and Mining sustained 6% of employment and 14% of output; and Electrical and Electronics Manufacturing supported 4% of employment and 6% of output.

Figure 4. Industrial Composition of Economic Base in Pittsburgh

Prepared by the Center for Economic Development using 2020 Moody's Analytics Data

Figure 5 below shows the Pittsburgh MSA's economic base industries, their employment specialization measured by LQ, and their output growth from 2017 to 2019. *Iron and Steel Mills and Ferroalloy Mfg* (Employment LQ=9.5) has the highest specialization in the area, supporting almost 6,000 jobs and reported output growth of nearly 16% between 2017 and 2019. *Support Activities for Mining* had the largest output growth between 2017 and 2019, nearly 41%. This growth is connected to the construction of the Shell Pennsylvania Petrochemicals Complex, a large ethylene cracker plant owned by Shell Oil Company, and the growth of related industries and support infrastructure. The cracker plant is creating construction jobs and is expected to sustain 600 permanent jobs, boosting plastic product manufacturing.[9] *Scientific Research and Development Services* (LQ=1.8) grew its output by nearly 28% between 2017 and 2019. The industry supports 10,600 jobs showing steady growth in employment in the region since 2003, and more so since 2013. This growth is attributed to new research corporations that have relocated to the region, as well as existing research enterprises that have expanded.[10] The growth of this industry is one of the main factors differentiating NEO and Pittsburgh economies.

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[9] Stonesifer, J. (2016, June 7). Shell confirms it will build cracker plant in Potter Twp. *The Times.*

[10] Center for Social & Urban Research. (2018). Expanding Research Employment in the Pittsburgh Region. University of Pittsburgh.

Figure 5. Pittsburgh Economic Base Industries
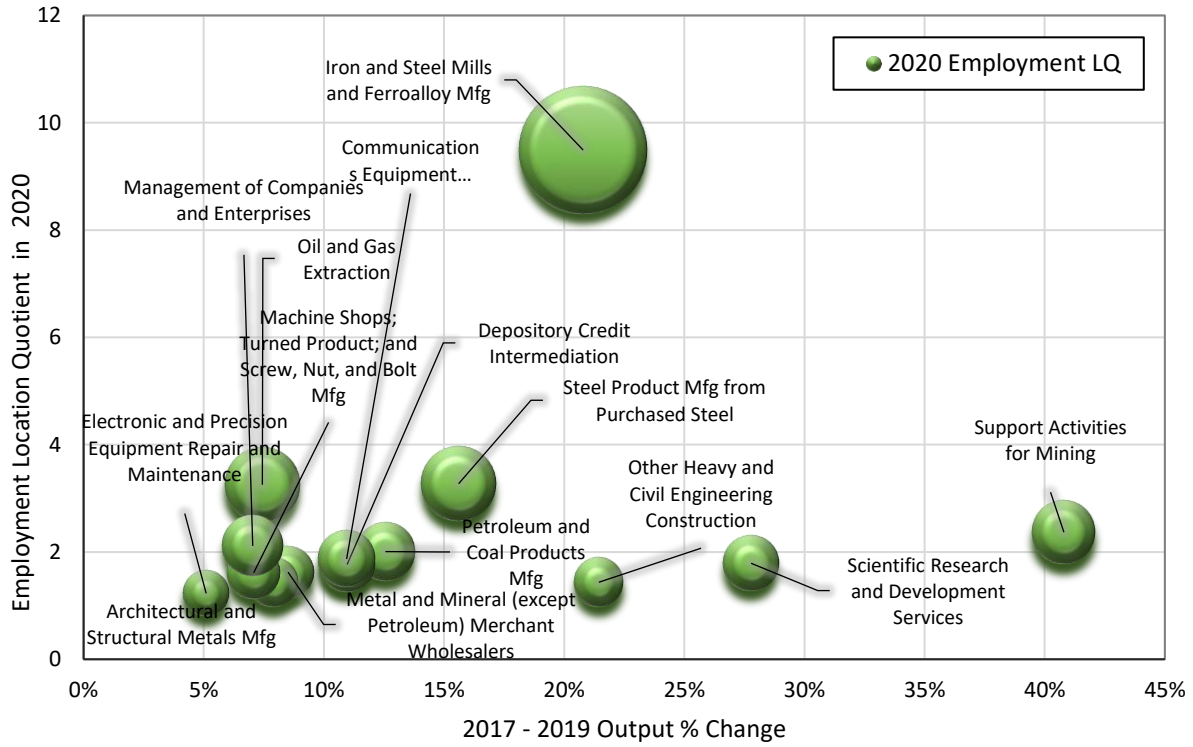
Note: Figure 5 shows Top 15 producing industries of a total of 24 industries in Pittsburgh's economic base
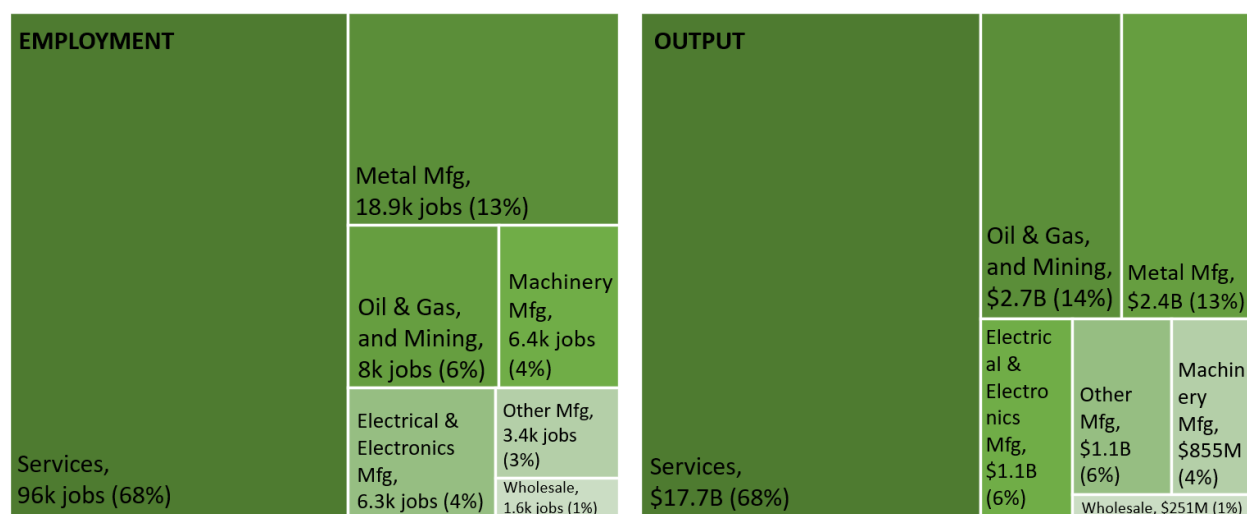Prepared by the Center for Economic Development using Moody's Analytics Data

SECTION II. ECONOMIC BASE OF YOUNGSTOWN

Manufacturing industries dominate the 2-county Youngstown region's economic base, similar to the 16-county NEO region. These industries combined contributed to 13% of the area's employment (19,000 jobs) and 19% of its output. Metal Manufacturing includes two sub-sectors: Fabricated Metal Product Manufacturing (NAICS Code 332) and Primary Metal Manufacturing (NAICS Code 331), which together constituted 43% of Youngstown's economic base's output and 38% of its employment (Figure 6). The Youngstown region has the highest specialization in Primary Metal Manufacturing as measured by high employment and output LQs in three industries: *Nonferrous Metal (except Aluminum) Production and Processing*, followed by *Steel Product Manufacturing from Purchased Steel*, and *Alumina and Aluminum Production and Processing* (Appendix Table A1). Transportation Equipment Manufacturing (NAICS Code 336), a historically relevant industry in the region, now has only a small share of the economic base, supporting 6% of its jobs and 8% of its output.

Figure 6. Industrial Composition of Economic Base in Youngstown

Prepared by the Center for Economic Development using 2020 Moody's Analytics Data

Figure 7 shows economic base industries in Mahoning and Trumbull counties, their employment specialization measured by LQ, and output growth from 2017 to 2019. The Youngstown region's wholesalers have been growing at a fast pace over the past few years. *Metal and Mineral (except Petroleum) Merchant Wholesalers*, an industry with an employment regional concentration 7 times greater than the national average, showed 23% output increase between 2017 and 2019. *Machinery, Equipment, and Supplies Merchant Wholesalers'* output grew 17% between 2017 and 2019. Although *Motor Vehicle Manufacturing* has high employment specialization (Employment LQ = 6.5), its output increased by only 2%.

Repair and maintenance of the industrial system for Advanced Manufacturing is an undersold value proposition in the region. The *Commercial and Industrial Machinery and Equipment (except Automotive and Electronic) Repair and Maintenance* industry grew 14% between 2017 and 2019. In 2020, companies in this industry employed almost 400 people. For example, The National Heat Exchange Cleaning Corporation offers repairs and maintenance for energy generation industries and plants cleaning, testing, and refurbishing heat exchangers. The Dearing Compressor and Pump Company with locations in Cleveland and Pittsburgh serves its industrial and energy customers

across the U.S. The company sells and rents equipment and systems for compressed air, gas, process gas, and hydraulic applications.

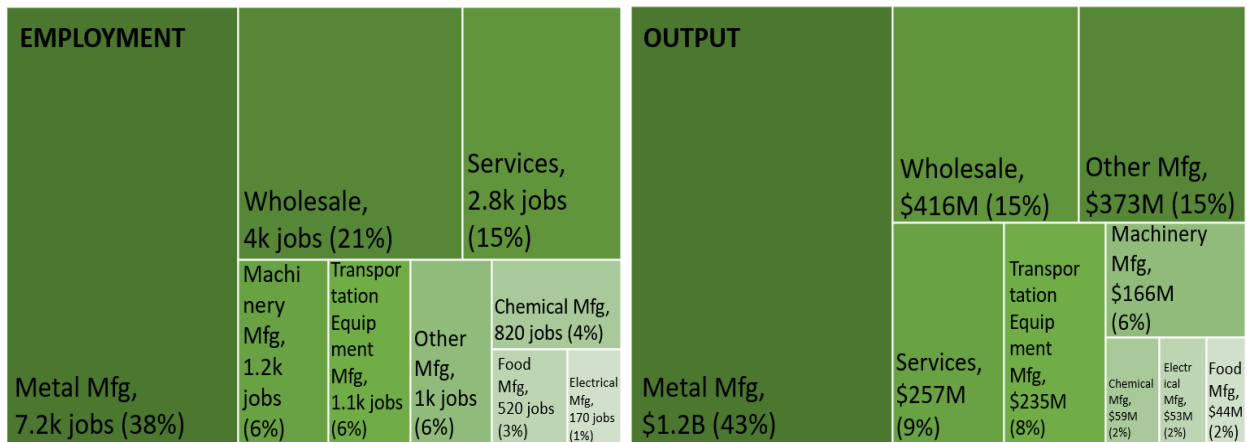**Figure 7. Youngstown Economic Base Industries**
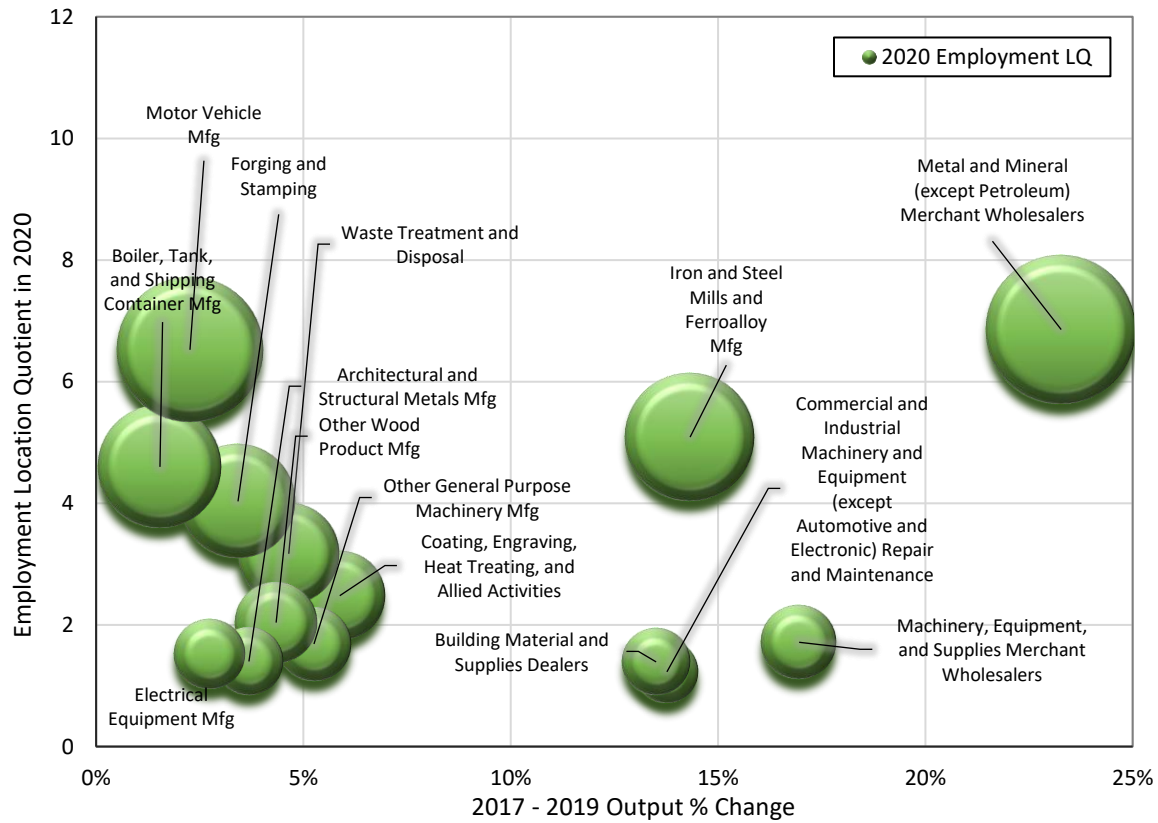
Note: Figure 7 shows Top 15 producing industries of a total of 28 industries in Youngstown's economic base
Prepared by the Center for Economic Development using Moody's Analytics Data

In addition to economic base industries, we analyzed a broader set of aspirational industries representing nine different sectors: Advanced Manufacturing, Automotive, Back Office, BioHealth, Energy, Financial Services, Food Processing, Information Technologies & Services (IT&S), Logistics, Other Manufacturing, R&D. These industries represent JobsOhio priority industry sectors and strongly considered by the regional constituencies as priorities for future development of the Youngstown region. Although LQs for these industries are not necessarily high, NEO and Pittsburgh economies demand a lot of input from many of these sectors (Appendix Tables A2-A3).

SECTION III. SUPPLY CHAIN OPPORTUNITIES

We used IMPLAN data on commodity demand of the economic base industries in the three regions studied (16-county NEO, Cleveland MSA, and Pittsburgh MSA). The IMPLAN input-output modeling software and social accounting data enabled us to conduct a regional analysis of trade flows between these neighboring economies.[11] Using the IMPLAN data, we discerned the input demand of the economic base industries (as one group) in the 16-county NEO region, Cleveland MSA, and Pittsburgh MSA. The demand is presented by the list of industries that sell their output to the economic base industries in each region. Then, we interlaid input demand from the 16-county NEO region, Cleveland MSA, Pittsburgh MSA's economic base industries with the output of Youngstown's economic base and aspirational industries (Table 1). Matching the demand from the three stronger neighboring economies with the potential supplies produced in Youngstown can identify additional opportunities for the short- and long-term growth of the regional economy.

Table 1. Out-of-Region Input Purchases

Industry	Out of Region Input Purchases – Pittsburgh MSA	Out of Region Input Purchases – 16-County NEO	Cumulative Input Purchases
Advanced Manufacturing	$297M	$1.3B	$1.6B
Other Manufacturing	$148M	$536M	$684M
Financial Services	$531M	$81M	$612M
Energy	$44M	$363M	$407M
Polymers and Chemicals	$65M	$318M	$383M
IT&S	$153M	$175M	$328M
Automotive Manufacturing	$56M	$190M	$246M
Logistics	$9M	$39M	$48M
Back Office	$21M	-	$21M
R&D	-	$5M	$5M
BioHealth	$1M	$3M	$4M
Food Processing	$3M	$236k	$3M
Total	**$1.3B**	**$3B**	**$4.3B**

Note: Prepared by the Center for Economic Development using IMPLAN 2019 data

Figure 8 shows the top five sectors with the highest input demand from the economic base industries in the 16-county NEO region and the Pittsburgh MSA. Cumulatively, these regions purchased $4.3 billion of inputs (Table 1). Of these, 85% ($3.7 billion) are purchased from Advanced Manufacturing, Other Manufacturing, Financial Services, Energy, and Polymers and Chemicals sectors. In the following sections, we analyzed the five sectors representing potential demand for the products of Youngstown.

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[11] The input data in the social accounting matrix tracks the commodity demand of every unique industry group through the supply chain (backward linkages).
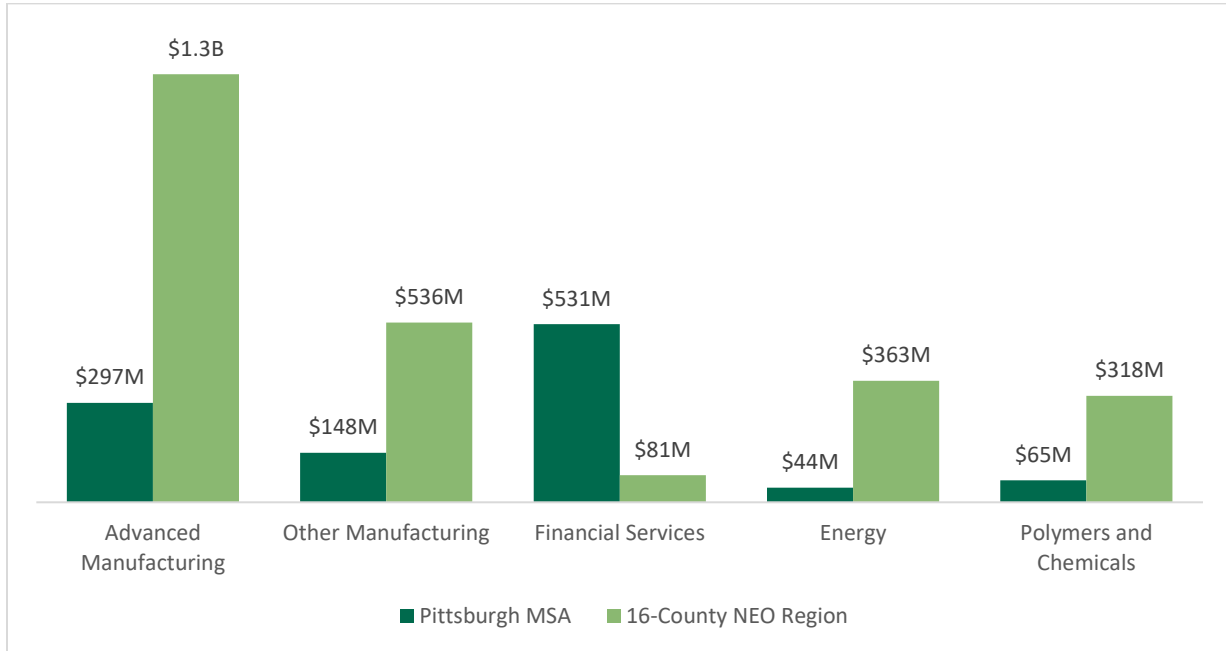
Note: Prepared by the Center for Economic Development using IMPLAN 2019 data

Advanced Manufacturing

Cumulatively, NEO and Pittsburgh's economic base industries purchased $1.6 billion worth of Advanced Manufacturing commodities from other regions (Table 1). For both regions, the *Nonferrous Metal (except Aluminum) Production and Processing* industry had the highest input purchases, totaling $911 million (Appendix Tables A2-A3). In 2019, NEO bought only a small portion of its Advanced Manufacturing inputs (4%) from Mahoning and Trumbull counties (Table 2) suggesting opportunities for Youngstown in servicing regional supply chains.

Within the NEO Region, the Advanced Manufacturing sector accounted for $1.3 billion in input purchases, representing 42% of the total regional input demand (Figure 8). The demand for Advanced Manufacturing inputs is divided between four industries: *Nonferrous Metal (except Aluminum) Production and Processing*; *Electrical Equipment Manufacturing*; *Steel Product Manufacturing from Purchased Steel;* and *Boiler, Tank, and Shipping Container Manufacturing*. Leveraging its local strengths, Youngstown can capture more of the input demand from these industries. In 2019, only 4% of the Advanced Manufacturing ($54M) purchases came from Trumbull and Mahoning counties, with $45.5M being bought from *Nonferrous Metal (Except Aluminum) Production and Processing.* This industry represents a potential gap in the regional supply chain that Youngstown firms can address.

Nearly $300 million dollars' worth of Advanced Manufacturing inputs were purchased from outside of the Pittsburgh MSA (Figure 8). In 2019, this region spent nearly $152 million on *Nonferrous Metal (except Aluminum) Production and Processing* input purchases from outside the area. Youngstown has an employment concentration 21 times greater than the national average within this industry. Due to its large employment (1,550 jobs) and output ($297 million) in *Nonferrous Metal (except Aluminum) Production and Processing*, Youngstown may be able to tap into the regional input demand and further its economic ties with Pittsburgh. In addition, Pittsburgh's

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economic base industries made nearly $44 million input purchases from *Other General Purpose Machinery Manufacturing*. In Youngstown, this industry supports nearly 500 jobs and reported a 5% growth in output between 2017 and 2019 (Figure 7).

Table 2. 16-County NEO Input Purchases from Youngstown

Industry Sector	Out-of-Region Input Purchases	Input Purchases from Youngstown	% of NEO Regional Input Purchases from Youngstown
Advanced Manufacturing	$1.3B	$54.0M	4.2%
Other Manufacturing	$535.8M	$23.7M	4.4%
Energy	$362.5M	$7.3M	2.0%
Financial Services	$81.1M	$6.8M	8.4%
Polymers and Chemicals	$317.5M	$3.9M	1.2%
IT&S	$175.4M	$2.4M	1.4%
Automotive Manufacturing	$190.1M	$2.2M	1.1%
Logistics	$39.2M	$1.9M	4.8%
R&D	$5.1M	$35.5K	0.7%
BioHealth	$3.4M	$12.5K	0.4%
Food Processing	$236.3K	$2.7K	1.2%
Total	**$3.0B**	**$102.1M**	**4.2%**

Note: Prepared by the Center for Economic Development using IMPLAN 2019 data

Other Manufacturing

Besides major manufacturing sectors (Advanced Manufacturing and Automotive Manufacturing), a number of smaller manufacturing industries showed strong demand for inputs that interlaid with Youngstown's economic base and aspirational industries. These industries together in the 16-county NEO region and the Pittsburgh MSA purchased commodities worth $684 million from outside their economies. The NEO region spent $536 million, nearly $24 million in Mahoning and Trumbull counties (Table 2).

Most of the inputs purchased were from *Alumina and Aluminum Production and Processing*. This industry with the other five industries in Other Manufacturing employed 3,610 people in Mahoning and Trumbull counties in 2020. These industries are represented by strong local manufacturing companies in Youngstown, including Astro Shapes, an aluminum extrusion and fabricator servicing building and construction markets; Star Extruded Shapes, Inc, a turnkey, custom aluminum extrusions, fabrication, and finishing company; and BRT Extrusions who provide aluminum products of various shapes and profiles to building, electrical, transportation, and other industries.

Financial Services

Financial Services is an aspirational sector for Youngstown. In 2019, out-of-region input purchases accounted for $612 million (Table 1). Nearly half of these purchases represented *Securities and Commodity Contracts Intermediation and Brokerage* (Appendix Tables A2-A3). Compared to the Advanced Manufacturing sector, Financial Services are labor-intense and provide good, high-paying jobs for the Youngstown region. In 2019, NEO bought 8% of its Financial Services inputs from Mahoning and Trumbull counties (Table 2). These purchases are led by *Insurance Carriers*, acquiring $6 million worth of services in Youngstown.

Most of the input purchases by the Financial Services sector ($531 million) occurred in Pittsburgh's supply chain: *Financial Investments Activities* and *Securities* ($258M in input

purchases) and *Commodity Contracts Intermediation and Brokerage* ($245M). In 2020, the Financial Services sector employed roughly 600 people in Youngstown. Some regional employers included Stifel, a financial management company; HBK CPAs & Consultants specializing in a variety of accounting, tax, and business consulting services; and Farmers National Bank offering mortgage loans with a wide range of banking products. This growth opportunity is driven by the demand from the Pittsburgh market and may help diversify the Youngstown economy.

Energy

The 16-county NEO region and Pittsburgh MSA purchased $406 million worth of Energy inputs from other regions (Table 1). Input demand was divided between three industries: *Oil and Gas Extraction*; *Electric Power Generation, Transmission and Distribution*; and *Petroleum and Coal Products Manufacturing*. Nearly half of all purchases represented *Oil and Gas Extraction.*

Energy inputs purchases from outside of the 16-county NEO region accounted for $363 million (Table 1). Only 2% of these were supplied to NEO by Youngstown, totaling $7 million in sales (Table 2). The region is ideally situated near large oil and gas deposits in the Marcellus and Utica Point Pleasant Shale formations. Youngstown, in particular, is ideally located for growth-oriented oil-and-gas-related businesses. Further growth in oil and gas businesses powers polymer, plastics, rubber and chemical manufacturing, with the potential to fuel many other advanced manufacturing segments.[12]

Youngstown has a strong potential to support the energy sector through its advanced manufacturing sectors, for example, through energy storage systems. Northern States Metal, a full-service custom aluminum extrusion provider, installs the largest solar panels in the country.[13] BRITE Energy Innovators located in Warren assists new energy startups focusing on renewable energy and electric mobility and provides business counseling to companies that want to be part of electrical vehicle infrastructure and charging. The Energy sector provides some of the highest paying jobs in the area.

Polymers and Chemicals

The Northeast Ohio region is home to nearly 1,000 polymer and materials companies.[14] The Polymers and Chemicals sector is represented by the *Plastic Product Manufacturing* industry (Appendix Table A4). This industry is poised for growth, as natural gas and gas liquids in Utica Shale deposits provide low-cost energy and a local source of raw materials.

Cumulatively, NEO's and Pittsburgh's economic base industries purchased $383 million worth of *Plastic Product Manufacturing* commodities from other regions (Table 1). In the 16-county NEO region, the *Plastic Product Manufacturing* industry purchased $318 million of inputs from outside the region. Purchases from Youngstown accounted for only 1% of these purchases, totaling nearly $4 million (Table 2). Dinesol Plastics, a plastic injection molding company, employs nearly 400 people in the Youngstown area.[15]

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[12] We Make Oil and Gas Businesses Prosper. (2019, July). TeamNEO and JobsOhio publication.

[13] Solar FlexRack Trackers Installed in Over 80 Agricultural Solar Projects in California. (2021, October 4). *Solar FlexRack News*.

[14] We Make the Polymer and Materials Industry Flourish. (2019, June). TeamNEO and JobsOhio publication.

[15] Dinesol Plastics Inc. History.

SUMMARY

The economic bases of NEO, the Pittsburgh MSA, and Youngstown contain similarities due to their proximity and shared industrial history. NEO and Youngstown are both dominated by the manufacturing industry, and while the Pittsburgh MSA's economy has a legacy of manufacturing, it is now more diverse. Economic base industries in the 16-county NEO region and the Pittsburgh MSA purchased $4.3 billion inputs outside these regions. The NEO region accounted for 70% of these input purchases. Of this, $102 million (4%) was acquired from Mahoning and Trumbull counties.

Youngstown's proximity to NEO and Pittsburgh, as well as the makeup of its economic base, position it as a high opportunity area for greater integration into the regional supply chain. The Youngstown region's economic strengths align with many NEO and Pittsburgh input needs. Such industries that can be targeted for growth include *Nonferrous Metal (Except Aluminum) Production and Processing*, *Alumina and Aluminum Production and Processing*, and *Plastic Product Manufacturing*. Some of these industries, like Nonferrous Metal and Aluminum production, already have large employment and output in the Youngstown area and can further support NEO and Pittsburgh Advanced Manufacturing.

Trumbull and Mahoning counties can also capitalize on the demand for Financial Services due to their prime location near the Pittsburgh banking system and insurance carriers in NEO. Opportunities arise in the Energy sector with the development of oil and gas deposits in the Marcellus and Utica Shale formations and growth in renewable energy sources and storage.

These opportunities for greater integration in the NEO and Pittsburgh supply chains could have large implications for the region's economic growth, infusing vitality back into the community. In the long run, more diversified economies create a sustainable cycle of economic activity where businesses continually feed off of one another and grow larger as the economy grows.[16] Through resulting output and employment gains, Youngstown can recover from blows to productivity and employment caused by the Lordstown GM plant closure and the COVID-19 pandemic.

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[16] Demko, I.; Lendel, I.; Piazza, M.; Figueroa, G.; and Ellerbrock, M. (2020). "Youngstown Economy: Recession and Path to Recovery". *Urban Publications*.

APPENDIX

Appendix Table A1. Top Economic Base Industries in Youngstown

NAICS Code	NAICS Description	Employment LQ 2020	Output LQ 2020
3314	Nonferrous Metal (except Aluminum) Production and Processing	20.9	45.7
3312	Steel Product Manufacturing from Purchased Steel	17.9	25.1
3313	Alumina and Aluminum Production and Processing	17.9	26.6
3271	Clay Product and Refractory Manufacturing	7.0	8.4
4235	Metal and Mineral (except Petroleum) Merchant Wholesalers	6.9	6.7
3361	Motor Vehicle Manufacturing	6.5	8.4
3311	Iron and Steel Mills and Ferroalloy Manufacturing	5.1	6.7
3324	Boiler, Tank, and Shipping Container Manufacturing	4.6	6.7
3321	Forging and Stamping	4.0	7.0
3335	Metalworking Machinery Manufacturing	3.5	3.7
5622	Waste Treatment and Disposal	3.2	4.3
3362	Motor Vehicle Body and Trailer Manufacturing	2.5	3.2
3328	Coating, Engraving, Heat Treating, and Allied Activities	2.5	4.3
3363	Motor Vehicle Parts Manufacturing	2.2	4.0

Prepared by the Center for Economic Development using Moody's Analytics Data

Appendix Table A2. 16-County NEO Region's Input Purchases Matched with Youngstown Economic Base and Aspirational Industries

NAICS Code	NAICS Description	16-County NEO region				Industry Sector
		Out-of-Region Input Purchases in 2019	% of Total Input Purchases	Input Purchases from Youngstown	% of NEO Input Purchases from Youngstown	
Part of Youngstown Economic Base						
3314	Nonferrous Metal (except Aluminum) Production and Processing	$759.5M	95.1%	$45.5M	6.0%	Advanced Mfg
3312	Steel Product Mfg from Purchased Steel	$128.3M	88.0%	$2.2M	1.7%	Advanced Mfg
3313	Alumina and Aluminum Production and Processing	$392.7M	94.6%	$17.8M	4.5%	Other Mfg
3324	Boiler, Tank, and Shipping Container Mfg	$114.1M	80.3%	$5M	4.4%	Advanced Mfg
3261	Plastics Product Mfg	$317.5M	84.2%	$3.9M	1.2%	Polymers and Chemicals
3241	Petroleum and Coal Products Mfg	$128.3M	60.4%	$5.7M	4.5%	Energy
3323	Architectural and Structural Metals Mfg	$131.1M	78.2%	$4.5M	3.5%	Other Mfg
3363	Motor Vehicle Parts Mfg	$190.1M	89.3%	$2.2M	1.1%	Automotive
3219	Other Wood Product Mfg	$11.9M	40.3%	$1.3M	11.0%	Other Mfg
3353	Electrical Equipment Mfg	$262.8M	96.7%	$1.1M	0.4%	Advanced Mfg
	Total	**$2.4B**	**89.3%**	**$89.3M**	**5.0%**	
Aspirational Industries						
2211	Electric Power Generation, Transmission and Distribution	$91.6M	26.0%	$0.7M	0.8%	Energy
2111	Oil and Gas Extraction	$142.6M	97.1%	$0.9M	0.6%	Energy
5417	Scientific Research and Development Services	$5M	40.8%	$0.02M	0.4%	R&D
5239	Other Financial Investment Activities	$5.2M	20.4%	$2.2M	1.9%	Financial Services
5415	Computer Systems Design and Related Services	$115.4M	28.1%	$0.1M	0.2%	IT
5231	Securities and Commodity Contracts Intermediation and Brokerage	$50.4M	35.4%	$0.1M	0.3%	Financial Services
5182	Data Processing, Hosting, and Related Services	$50.3M	16.0%	$0.3M	2.1%	IT
4881	Support Activities for Air Transportation	$13.4M	98.0%	$0.01M	0.4%	Logistics
3391	Medical Equipment and Supplies Mfg	$3.4M	19.9%	$0.04M	0.2%	BioHealth
3332	Industrial Machinery Mfg	$10.9M	89.6%	$0.1M	1.2%	Advanced Mfg
5222	Nondepository Credit Intermediation	$12.6M	24.6%	$0.3M	2.3%	Financial Services
4931	Warehousing and Storage	$25.8M	18.1%	$1.6M	6.2%	Logistics
3116	Animal Slaughtering and Processing	$0.24M	92.3%	$0.003M	1.2%	Food Processing
5241	Insurance Carriers	$9.9M	12.2%	$6.4M	64.4%	Financial Services
5112	Software Publishers	$9.6M	62.0%	$0.7M	0.8%	IT
3272	Glass and Glass Product Mfg	$665K	95.8%	$0.004M	0.6%	Advanced Mfg
	Total	**$550.1M**	**48%**	**$12.9M**	**32.9%**	

Appendix Table A3. Pittsburgh's Input Purchases Matched with Youngstown Economic Base and Aspirational Industries

NAICS Code	NAICS Description	Pittsburgh MSA		Industry Sector
		Out-of-Region Input Purchases in 2019	% of Total Input Purchases	
Part of Youngstown Economic Base				
3314	Nonferrous Metal (except Aluminum) Production and Processing	$151.6M	91.6%	Advanced Mfg
3313	Alumina and Aluminum Production and Processing	$46M	97.9%	Other Mfg
3324	Boiler, Tank, and Shipping Container Mfg	$4M	96.9%	Advanced Mfg
3261	Plastics Product Mfg	$65.3M	93.4%	Polymers and Chemicals
3321	Forging and Stamping	$14.8M	82.5%	Other Mfg
3339	Other General Purpose Machinery Mfg	$43.5M	98.5%	Advanced Mfg
3323	Architectural and Structural Metals Mfg	$47M	82.8%	Other Mfg
3363	Motor Vehicle Parts Mfg	$56.3M	98.3%	Automotive
3219	Other Wood Product Mfg	$9.9M	49.2%	Other Mfg
3353	Electrical Equipment Mfg	$22.8M	94.6%	Advanced Mfg
3328	Coating, Engraving, Heat Treating, and Allied Activities	$23.7M	78.0%	Other Mfg
3329	Other Fabricated Metal Product Mfg	$74.1M	92.1%	Advanced Mfg
3271	Clay Product and Refractory Mfg	$6.2M	28.6%	Other Mfg
	Total	**$565M**	**91.0%**	
Aspirational Industries				
2111	Oil and Gas Extraction	$43.9M	64.7%	Energy
5239	Other Financial Investment Activities	$257.8M	19.5%	Financial Services
5614	Business Support Services	$6.2M	14.5%	Back Office
5415	Computer Systems Design and Related Services	$116M	13.4%	IT&S
5231	Securities and Commodity Contracts Intermediation and Brokerage	$244.8M	47.1%	Financial Services
5182	Data Processing, Hosting, and Related Services	$27.2M	21.0%	IT&S
4881	Support Activities for Air Transportation	$8.3M	21.4%	Logistics
3391	Medical Equipment and Supplies Mfg	$1.2M	97.6%	BioHealth
3332	Industrial Machinery Mfg	$0.8M	97.2%	Advanced Mfg
5222	Nondepository Credit Intermediation	$28.5M	43.4%	Financial Services
4931	Warehousing and Storage	$1.1M	13.5%	Logistics
3116	Animal Slaughtering and Processing	$0.8M	95.8%	Food Processing
5611	Office Administrative Services	$14.8M	83.3%	Back Office
3121	Beverage Mfg	$1.7M	67.5%	Food Processing
5112	Software Publishers	$10M	13.5%	IT&S
3272	Glass and Glass Product Mfg	$7.4K	96.4%	Advanced Mfg
	Total	**$763M**	**32.0%**	

Prepared by the Center for Economic Development using IMPLAN 2019 data

Appendix Table A4. Youngstown's Economic Base and Aspirational Industries Interlaid with NEO and Pittsburgh Input Demand

NAICS Code	NAICS Description
Advanced Manufacturing Sector:	
3272	Glass and Glass Product Manufacturing
3312	Steel Product Manufacturing from Purchased Steel
3314	Nonferrous Metal (except Aluminum) Production and Processing
3324	Boiler, Tank, and Shipping Container Manufacturing
3329	Other Fabricated Metal Product Manufacturing
3332	Industrial Machinery Manufacturing
3339	Other General Purpose Machinery Manufacturing
3353	Electrical Equipment Manufacturing
Other Manufacturing Sector:	
3219	Other Wood Product Manufacturing
3271	Clay Product and Refractory Manufacturing
3313	Alumina and Aluminum Production and Processing
3321	Forging and Stamping
3323	Architectural and Structural Metals Manufacturing
3328	Coating, Engraving, Heat Treating, and Allied Activities
Financial Services Sector:	
5222	Nondepository Credit Intermediation
5231	Securities and Commodity Contracts Intermediation and Brokerage
5239	Other Financial Investment Activities
5241	Insurance Carriers
Energy Sector:	
2111	Oil and Gas Extraction
2211	Electric Power Generation, Transmission and Distribution
3241	Petroleum and Coal Products Manufacturing
Polymers and Chemicals Sector:	
3261	Plastics Product Manufacturing
Information Technology & Services (IT&S) Sector:	
5112	Software Publishers
5182	Data Processing, Hosting, and Related Services
5415	Computer Systems Design and Related Services
Automotive Manufacturing Sector:	
3363	Motor Vehicle Parts Manufacturing
Logistic Sector:	
4881	Support Activities for Air Transportation
4931	Warehousing and Storage
Back Office Sector:	
5611	Office Administrative Services
5614	Business Support Services
R&D Sector:	
5417	Scientific Research and Development Services
BioHealth Sector:	
3391	Medical Equipment and Supplies Manufacturing
Food Processing Sector:	
3116	Animal Slaughtering and Processing
3121	Beverage Manufacturing