U.S. Chamber of Commerce

The Community Economic Impact of New Distribution Centers

Executive Summary

Distribution Centers (DC), also known as fulfillment centers, are an increasingly important part of retail and the overall economy because of the rise of online commerce. Some critics argue that distribution centers (the term used throughout this report for expediency) are a drag on the economies where businesses build them.

Economic research conducted by the U.S. Chamber of Commerce provides an analysis of new distribution centers that takes into account the full scope of a center's impact on local economies. This research used a model of 30 Metropolitan Statistical Areas (MSAs) that represent the geography and population distribution of the U.S. economy. The analysis dispels the inaccurate arguments from critics. On average, a new DC employing 3,000 workers resulted in 5,111 total new jobs in an MSA, including those 3,000 at the new DC, and sustained those new jobs over a 20-year period. Importantly, for every job created directly by a new DC, there are an additional 0.7 jobs created in the MSA.

These economic engines produce the following benefits annually at the MSA level:

- Create more than 5,100 jobs.
- Expand the labor force by more than 3,500 workers.
- Increase personal income by $500 million.
- Grow salaries and wages by $360 million, which results in raising average annual salaries and wages 1.8% each year over the life span of a DC.

In arguing to maintain the status quo, critics of DCs miss how strongly beneficial the investment in a new DC can be for local workers in the warehouse industry, workers in other industries in the area, and the broader economic benefits to the community.

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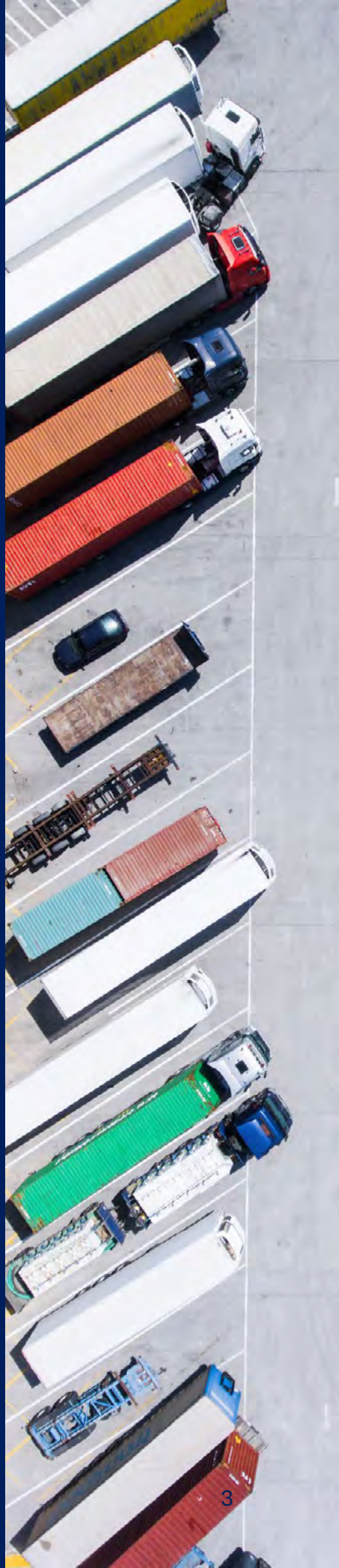
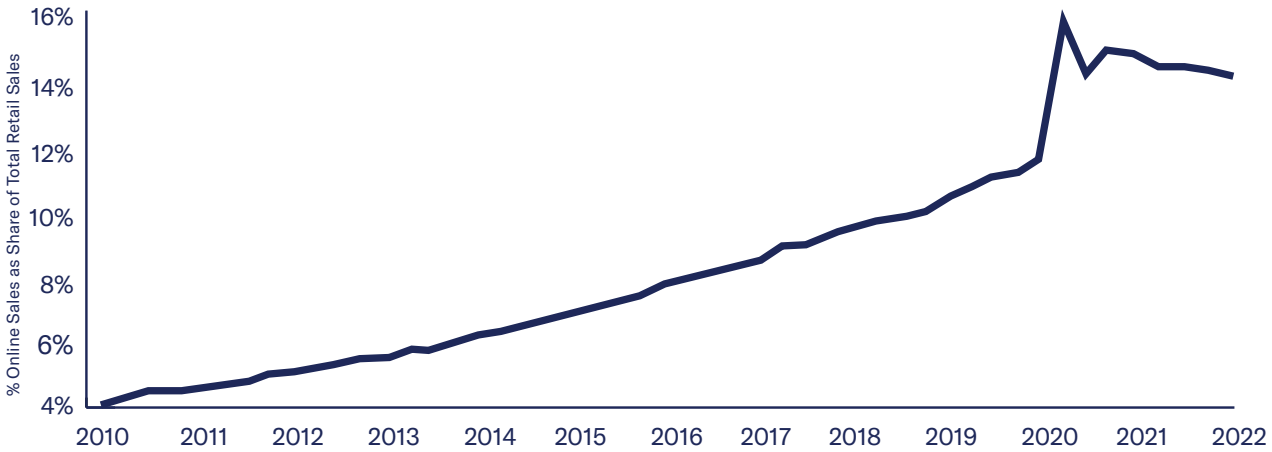


Introduction

Distribution Centers (DCs) are an increasingly integral part of the U.S. economy. As retail evolves from traditional brick-and-mortar stores to include more selling through e-commerce channels, the significance of these technologically advanced engines of commerce will continue to rise. A distribution center connects the local economy directly into an immense global stream of commerce.

Shoppers have been shifting to online buying since the internet started; however, the COVID-19 pandemic accelerated the shift. Trends such as buy-at-home-pick-up-in-store have driven this shift. In early 2020, about 12% of retail sales were made online. By mid-2020, that share spiked to over 16%. It is now about 13%, below the COVID-19 spike but above the pre-COVID-19 trend. To accommodate and meet the demand of customers' move to online shopping, retailers and other businesses are relying on DCs more than they were prior to the pandemic.

Online Sales Share of Total Retail Has Been Rising for Years–Spiked During the Pandemic



DCs are not traditional warehouses. These high-tech distribution hubs require the businesses that open them to invest hundreds of millions of dollars. That includes investment in the buildings, as well as the advanced technological, safety, and logistical equipment used in DCs to carry out their complex processes. Warehouses require similar investment for the buildings but not the other infrastructure. For instance, some DCs have almost 20 miles of conveyor belts to move items through the center. Those conveyor systems alone require ample physical infrastructure and advanced robotics and software technology to move items from one area to the proper areas they are going to safely and swiftly. Warehouses do not use these capabilities to the same extent.

Understanding the operational differences between DCs and traditional warehouses is key to grasping their economic effect. This analysis captures DCs' distinct economic impact by leveraging a model that accounts for the required capital investment to open a facility and the specialists to operate it.

Traditional warehouses take bulk goods in, store them for prolonged periods, and then send them out again at some point in the future. In contrast, DCs, using the large investments needed to operate them, take in different bulk goods from a variety of vendors, store those products in ways that allow for quickly filling orders, then repack the products to meet countless customers' orders. This includes labeling the orders accurately, packing orders together for shipment out of the center, then loading trucks that take orders on the next leg of their journey or to their final destination.

The investment needed to operate and maintain a DC with all these advanced capabilities is immense. The mix of workers needed to operate a DC is also different than what is needed for a warehouse. A complete analysis of the economic impact of DCs must account for these crucial facts.

"Understanding the operational differences between DCs and traditional warehouses is the key to grasping their economic effect... A complete analysis of the economic impact of DCs must account for [this] crucial fact."

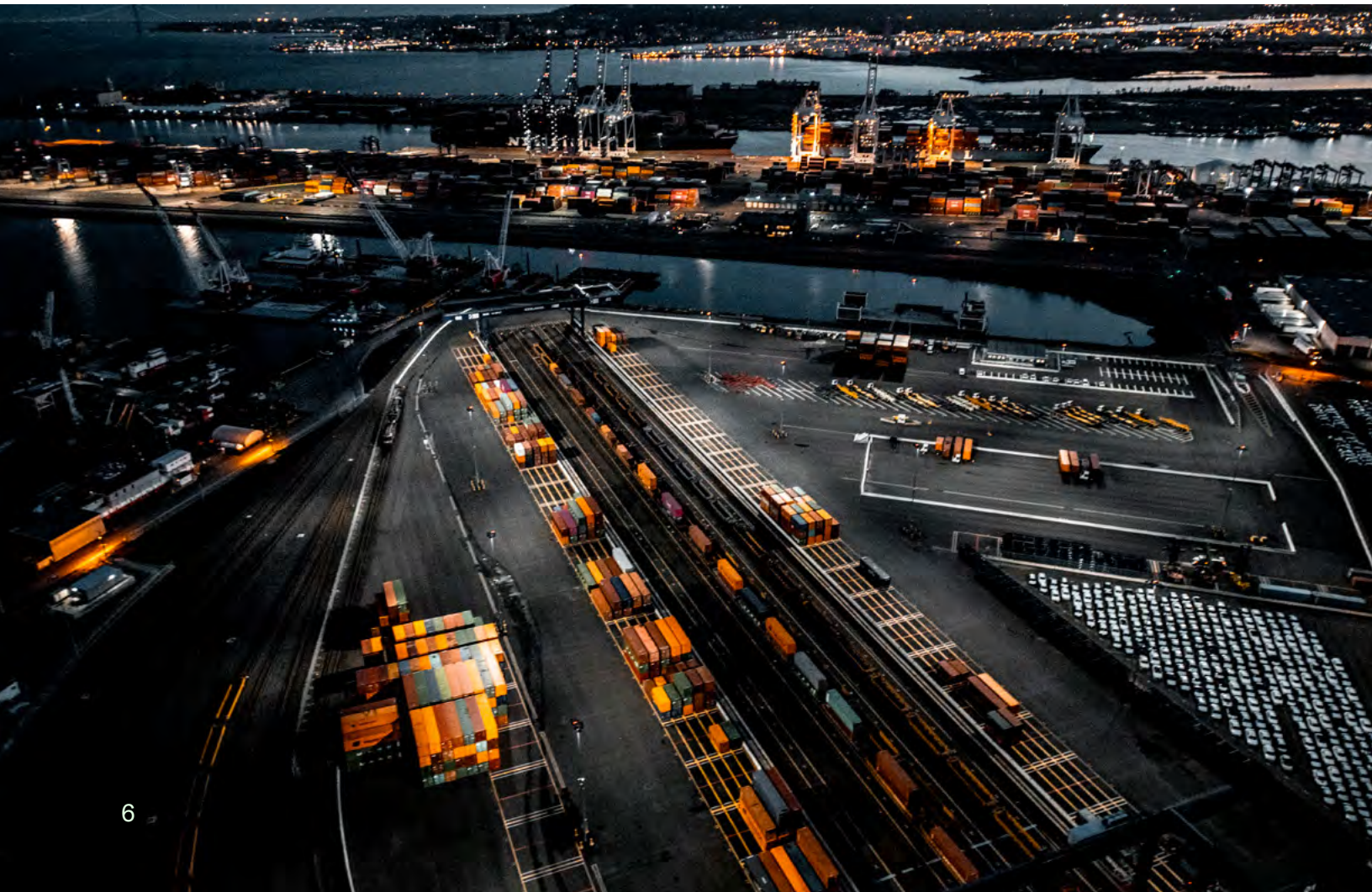
The value added by DCs is larger than that of warehouses. Comparing the two is the equivalent of assuming that the economic impact of a car is the same as a horse and buggy because they are both transportation vehicles. The sheer volume of products and number of different items moved through DCs make them incomparable to warehouses. Add to that the way DCs match the orders of customers with multiple vendors instantly in one location and the comparison becomes even more strained.

The growing importance and large investment DCs represent on behalf of the retailers and businesses that open and run them suggest they have sizeable positive economic benefits in the areas and regions where they operate. However, critics contend they do the opposite, arguing that DCs do the following:

- Lower the wages of warehouse workers.
- Reduce jobs in the warehouse industry or the localities where centers open.
- Hurt warehouse workers by creating temporary, unreliable jobs.

These arguments raise an interesting question about the actual effect of DCs on the communities where companies open them. As they continue to grow in importance, those communities that gain DCs should have a sense of what to expect once the centers are operational. Having a deeper understanding will help communities guide economic development strategies when it comes to DCs and their resulting economic imprint on the area.

The U.S. Chamber of Commerce conducted an economic analysis to calculate that effect and settle the debate over unsubstantiated criticisms that opponents often make against DCs. The results dispel critics' arguments by showing that DCs have a strong positive impact on the local economies and workforces where businesses invest in them.



Research Method

To study the economic impact of building a new DC in a region, the Chamber used a model of 30 unique Metropolitan Statistical Areas (MSAs) representing the geographic and population distribution of the U.S. The populations of the MSAs ranged from 20 million to less than 100,000.

We added one new DC in each of these MSAs to measure the impact of that new DC in that particular area. We added the DCs separately to the respective MSAs so that we could isolate the impacts of that particular DC in the specific MSA. Therefore, we conducted 30 separate analyses. We assumed that each of the 30 new DCs needed 3,000 workers and had a useful life of 20 years.

Of those 3,000 new workers, we assumed some were employed in occupations that are also found in traditional warehouses and storage facilities, such as the following:

- Packers
- Unpackers
- Truck loaders and unloaders
- Inventory managers
- Forklift operators
- Machine operators
- Freight handlers
- Logistics experts
- Order fillers
- Office and administrative support
- Maintenance and repair workers

Since DCs need higher-skilled jobs in addition to traditional warehouse jobs, researchers added 30 workers in those positions to the model as well. Examples of these occupations are as follows:

- Software engineers and developers
- Mechanical engineers
- Electrical engineers
- Robotics engineers
- Robotics programmers
- Machine learning experts
- Data analysts
- Data scientists
- Cloud engineers and analysts

Assigning workers to these categories reflects the fact that DCs are more advanced, modern, and full of technological applications than traditional warehouses. Our research also accounted for the investment in DC-specific infrastructure like the conveyor systems, robotics, software, and other mechanical systems.
We used the REMI PI+ model to conduct the analysis. In short, according to REMI—

“DCs are more advanced, modern, and full of technological applications than traditional warehouses.”

PI+ is a structural economic, demographic, and fiscal forecasting and policy analysis model. The model integrates input-output, computable general equilibrium, econometric and economic geography methodologies. The model is dynamic, with forecasts and simulations generated on an annual basis and behavioral responses to compensation, price, and other economic factors.

The model consists of thousands of simultaneous equations with a structure that is relatively straightforward. The exact number of equations used varies depending on the extent of industry, demographic, demand, and other detail in the specific model being used. The overall structure of the model can be summarized in five major blocks: (1) Output and Demand, (2) Labor and Capital Demand, (3) Population and Labor Supply, (4) Compensation, Prices, and Costs, and (5) Market Shares.

A more detailed description of the REMI model is found in Appendix 1.

The REMI model is a powerful tool for this analysis because the full economic impact of new DCs is larger than the direct impact on the warehouse sector in a region. New centers benefit the construction companies that build them, the vendors that outfit them and service the machinery and mechanics, and the other businesses that service the centers directly, especially because of the advanced technology they require.

In addition, there is a spillover effect from having more investment and more workers in the area. Businesses that do not work directly with the DC experience growth. Those businesses see increased activity because of new spending in the community. They increase how much they spend in other area businesses for materials, supplies, and business services. And the new workers employed directly at the DC spend at other establishments in the region.

Analysts often focus their studies narrowly on the warehouse sector in a region, missing these important knock-on effects. The REMI model captures these other positive benefits and therefore gives a more complete picture of how DCs impact the localities where they operate.

Results

Overall Impacts

The results of the analysis clearly show that building and operating a new DC has a substantial positive economic effect on the region where it is located. It creates jobs and raises wages for workers in the area.

On average, a new DC employing 3,000 workers created 5,111 new jobs in an MSA, sustained over a 20-year period. It caused the labor force to grow by 3,557 workers. Since job growth exceeds growth in the labor force, each person entering the labor force in an MSA is employed. Previously unemployed workers and new entrants to the workforce in the MSA fill the remaining jobs, leading to a lower unemployment rate in the MSA.

> "A new DC employing 3,000 workers created 5,111 new jobs in an MSA, sustained over a 20-year period."

Importantly, job growth in excess of the jobs at the DC was substantial. On average, the spillover effect of a new DC is an additional 2,111 jobs in an MSA (the 3,000 DC jobs subtracted from the 5,111 new jobs in the MSA). In other words, for every job created at a new DC, there are an additional 0.7 jobs created in the MSA. Put another way, for every 100 jobs a DC adds, the MSA sees an additional 70 jobs created at other businesses.

Table 1

Average Job and Labor Market Growth Created by a New Distribution Center (All MSAs)				
	Jobs Created in the DC	Extra Jobs Created Outside of a New DC	Total New Jobs Created by the New DC	Growth in Labor Force
All MSAs	3,000	2,111	5,111	3,557
*Average sustained job creation over 20-year life span of a new Distribution Center.				

Table 2

Average Income Growth Generated By a New Distribution Center (All MSAs)		
	Increase of Personal Income ($)	Increase of Salaries and Wages ($)
All MSAs	$508,283,333	$358,530,000
*Average per year over 20-year life span of a new Distribution Center		

The impact measured in dollars is similarly strong. Over 20 years, a new DC increased total personal income in an MSA by over $500 million annually. Personal income includes all forms of income, most of which comes from compensation from working (including fringe benefits), but it also includes government transfers, business income, and returns on assets. Salaries and wages, the cash compensation workers earn, rose about $360 million on average each year during that two-decade period.

Those figures are an aggregate amount for the entire MSA and are broadly distributed among all workers in the region—not just the new workers at the DC.

In fact, the salaries and wages of all workers rise when a new DC enters an MSA. On average, they rise 1.8% annually for the 20-year life of the DC. This means that in any given year in the 20-year period workers' salaries and wages will be almost 2% higher than they would have been had a new DC not entered the MSA.

Interestingly, the effects are stronger for smaller MSAs. For those with populations under 250,000, salaries and wages grow a robust 6.1%. For MSAs 250,000 to 1 million, they grow 2.2%. The growth for larger MSAs is modest but positive. See Table 3 for salary and wage growth by MSA size.

Table 3

Average % Increase of All Workers' Salary and Wages	
MSA by Size	% Increase of Salaries and Wages
All MSAs	1.8%
Over 5 million	0.1%
2.5 million - 5 million	0.2%
1 million - 2.5 million	0.5%
250,000 - 1 million	2.2%
Under 250,000	6.1%
*Average per year over 20-year life span of a new Distribution Center	

Impacts by MSA Size

For a more granular look at the benefits of new DCs, the effects can also be broken out by MSA size. For instance, for MSAs with populations over 5 million, a new 3,000-worker DC resulted in more than 5,300 workers, or more than 2,300 in addition to the 3,000 jobs directly created by the DC. The labor force grew more than 3,500.

For MSAs with populations under 250,000, the impact is similarly substantial. A new DC created more than 4,800 jobs, or more than 1,800 jobs outside the DC. The labor force jumped more than 3,400.

See Table 4 for the results of MSAs with populations between 250,000 and 5 million.

Table 4

New Distribution Centers Create Jobs and Grow the Labor Force in an MSA			
MSA by Size	Jobs Created by New DC	Extra Jobs created Outside of New DC	Growth in Labor Force
Over 5 million	5,357	2,357	3,547
2.5 million – 5 milliion	5,307	2,307	3,754
1 million – 2.5 million	5,049	2,049	3,481
250,000 – 1 million	4,995	1,995	3,549
Under 250,000	4,846	1,846	3,456
Average sustained job creation over 20-year life span of a new Distribution Center.			

The income effects are also broken out by MSA size. For MSAs larger than 5 million, a new DC increased personal income more than $638 million and salaries and wages more than $442 million per year over 20 years.

For MSAs under 250,000, personal income rose more than $431 million; salaries and wages, almost $297 million.

See Table 5 for the results of MSAs with populations between 250,000 and 5 million.

Table 5

New Distribution Centers Increase Income and Raise Wages in an MSA		
MSA by Size	Increase of Personal Income ($)	Increase of Salaries and Wages ($)
Over 5 million	$638,233,333	$442,516,667
2.5 million - 5 million	$576,783,333	$410,583,333
1 million - 2.5 million	$464,500,000	$332,116,667
250,000 - 1 million	$430,183,333	$310,525,000
Under 250,000	$431,716,667	$296,908,333
* Average per year over 20-year life span of a new Distribution Center		

The spillover effect of a new DC within the MSA creates jobs in other industries in the MSA. Those job gains for other industries are listed in Appendix 2.

There are further spillover effects for the rest of the country when a business builds a new DC in a particular MSA. Those effects are presented in Appendix 3.

These results are likely lower-bound estimates because the researchers made conservative assumptions about the compensation of DC workers and the number of nontraditional warehouse roles.

The number may be higher in many DCs. Increasing the number of more skilled workers in the model would increase how many jobs a new DC creates and how much it grows personal income and salaries and wages.

> "The salaries and wages of all workers rise when a new DC enters an MSA. On average, they rise 1.8% annually over the 20-year life of the DC."

Answering the Critics

Critics often argue that new DCs harm workers in the warehouse industry and the communities where businesses build them. Each specific criticism is rebutted below:

- Criticism 1: New DCs lower wages for warehouse workers.

  - *Response*: Clearly, a new DC raises total personal income and salaries and wages in an MSA by substantial amounts. We can also dig deeper into the output from the REMI model to look at how a new DC impacts the salaries and wages of workers in the warehousing industry in the MSA where the new DC is located.

On average, salaries and wages increase $3,122 per worker per year in the warehouse sector when a new DC is built. This works out to an additional $1.50 per hour, or an extra $60 a week. As seen Table 6, the impact is also measured by MSA size, with the largest impact at the smallest MSAs.

The $3,122 in higher salaries and wages is the average for all workers in the warehouse sector. The increase in salaries and wages is larger for the more skilled, technical workers added in the new DC, but all workers in the industry, no matter their skill level, see strong growth in their earnings.

Table 6

New Distribution Centers Increase Salaries and Wages in the Warehouse Industry	
MSA by Size	Annual Increase of Salaries and Wages Per Worker ($)
All MSAs	$3,122
Over 5 million	$2,476
2.5 million – 5 million	$2,639
1 million – 2.5 million	$2,894
250,000 – 1 million	$3,220
Under 250,000	$4,166
*Average per year over 20-year life span of a new Distribution Center	

Despite the criticism, in total, workers in the warehouse industry see their salaries and wages grow when a new DC enters an MSA. Further, it is important to remember that salaries and wages for all workers grow when a new DC enters an MSA.

"Salaries and wages increase $3,222 per worker per year in the warehouse sector. This works out to an additional $1.50 per hour, or $60 a week."

- Criticism 2: New DCs hurt warehouse workers by creating temporary, unreliable jobs.

  - *Response*: A New DC in an MSA helps all industries in an MSA, including the warehouse industry.

A new DC creates 45 new, permanent, and full-time jobs in the warehousing industry on average due to the spillover growth effects of the MSA. Those are in addition to the 3,000 direct jobs created by the new DC in the industry. The jobs created by MSA size are listed in table 7.

New DCs benefit workers in the warehouse industry above their direct impact.

Table 7

New Distribution Centers Increase Jobs in the Warehouse Industry	
MSA by Size	Warehouse Jobs Created (including 3,000 at new DC)
All MSAs	3,045
Over 5 million	3,205
2.5 million – 5 million	3,052
1 million – 2.5 million	3,087
250,000 – 1 million	3,054
Under 250,000	3,006
*Average sustained job creation over 20-year life span of a new Distribution Center.	

"More jobs, higher salaries and wages, and a larger economy are all signs of progress, not harm, for any community."

- Criticism 3: New DCs are harmful to the economies and communities where businesses build them.

  - *Response*: Jobs and salaries and wages rise substantially when a business builds a new DC in an MSA, as does the size of the area's economy. Moreover, jobs and incomes grow for workers in the warehouse sector in the MSA—above the direct impact of the new DC. So, clearly, warehouse workers are better off in an MSA where a business builds a new DC.

More jobs, higher salaries and wages, and a larger regional economy are all signs of progress, not harm, for any community.

Case Studies

The results discussed so far are for unnamed areas. Case studies for particular MSAs where businesses build hypothetical new DCs further highlight their beneficial economic impact.

Atlanta, Georgia

The Atlanta-Sandy Springs-Alpharetta MSA (Atlanta) has a population of more than 6 million. The averages for an MSA of more than 5 million are listed in tables 3 through 7. We can model exact numbers for Atlanta specifically.

A new 3,000-worker DC in the Atlanta MSA would result in the following:

- 5,220 more jobs on average per year sustained over 20 years, or an additional 2,220 on top of those created directly at the new DC.
- .74 jobs created in the MSA for every job created at the new DC.
- Nearly 3,600 workers entering the workforce.
- Personal income rising by $535 million.
- Salaries and wages growing by almost $366 million.
- 0.14% growth in the average salaries and wages of all workers.

St. Louis, Missouri

The St. Louis MSA has a population of more than 2.8 million. The averages for an MSA of 2.5 million to 5 million people are listed in tables 3 through 7. We can model exact numbers for St. Louis specifically.

A new 3,000-worker DC in the St. Louis MSA would result in the following:

- More than 4,950 new jobs on average per year sustained over 20 years, or an additional 1,950 on top of those created directly at the new DC.
- .65 jobs created in the MSA for every job created at the new DC.
- Almost 3,500 workers entering the workforce.
- Personal income rising by $485 million.
- Salaries and wages growing by almost $345 million.
- 0.25% growth in the average salaries and wages of all workers.

Pittsburgh, Pennsylvania

The Pittsburgh, PA Metro Area MSA has a population of over 2.3 million. The averages for an MSA of 1 million to 2.5 million people are listed in tables 3 through 7. We can model exact numbers for Pittsburgh specifically.

A new 3,000-worker DC in the Pittsburgh MSA would result in the following:

- 4,840 more jobs on average per year sustained over 20 years, or an additional 1,840 on top of those created directly at the new DC.
- .61 jobs created in the MSA for every job created at the new DC.
- 3,450 workers entering the workforce.
- Personal income rising by $480 million.
- Salaries and wages growing by almost $350 million.
- 0.31% growth in the average salaries and wages of all workers.

Omaha, Nebraska

The Omaha-Council Bluffs, NE-IA Metro Area MSA (Omaha) has a population of around 950,000. The averages for an MSA of 250,000 to 1 million people are listed in tables 3 through 7. We can model exact numbers for the Omaha area specifically.

A new 3,000-worker DC in the Omaha MSA would result in the following:

- Almost 5,700 more jobs on average per year sustained over 20 years, or an additional 2,700 on top of those created directly at the new DC.
- .9 jobs created in the MSA for every job created at the new DC.
- More than 3,800 workers entering the workforce.
- Personal income rising by more than $520 million.
- Salaries and wages growing by $390 million.
- 1.1% growth in the average salaries and wages of all workers.

Bangor, Maine

The Bangor, ME Metro Area MSA (Bangor) has a population of approximately 150,000. The averages for an MSA under 250,000 people are listed in tables 3 through 7. We can model exact numbers for the Bangor area specifically.

A new 3,000-worker DC in the Bangor MSA would result in the following:

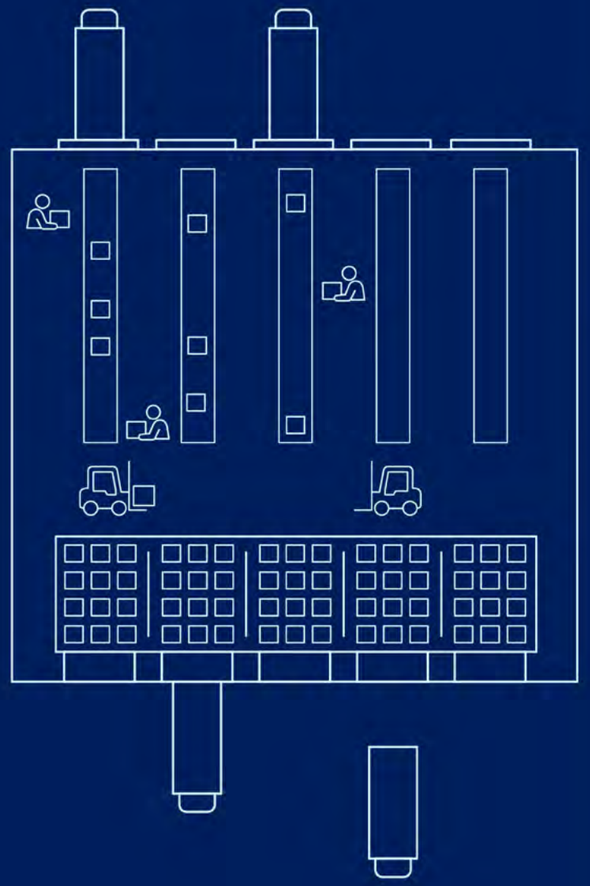
- Almost 4,900 more jobs on average per year sustained over 20 years, or an additional 1,900 on top of those created directly at the new DC.
- .63 jobs created in the MSA for every job created at the new DC.
- 3,480 workers entering the workforce.
- Personal income rising by $438 million.
- Salaries and wages growing by more than $300 million.
- 5.6% growth in the average salaries and wages of all workers.

Distribution Center Occupational Analysis

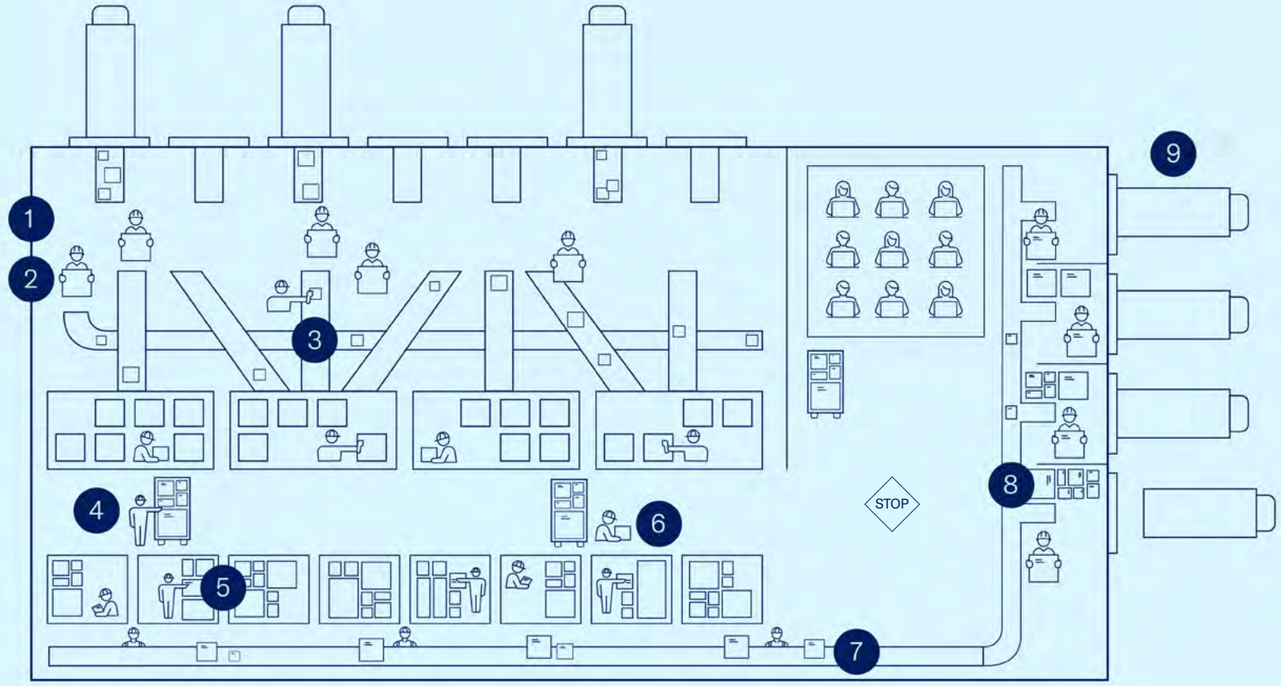
DCs are more advanced than traditional warehouses. They require additional skilled workers that warehouses do not employ. They also utilize cutting-edge technology not needed in warehouses. And DCs carry out tasks and functions that warehouses do not. As such, DCs require much more investment to build and run than warehouses.

The graphics below are included to help show the significant differences between the two.

Traditional Warehouse

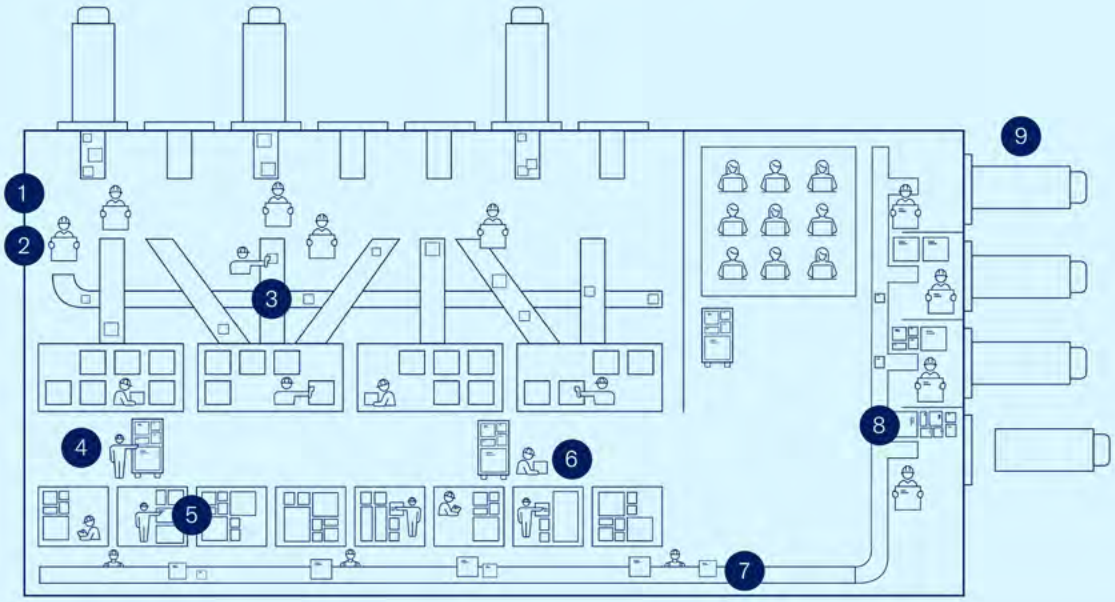


Distribution Center



1 Unloading
2 Breaking down
3 Identifying for storage
4 Storing
5 Identifying order
6 Picking
7 Conveying
8 Packing
9 Shipping

Distribution Center



1
Unloading
Workers unload large boxes from the semitrucks onto pallets.

2
Breaking Down
Large pallets are broken down into smaller sizes that are more manageable for storers to work with.

3
Identifying for Storage
This is where the engineers get involved. The employee now scans the item so that the cloud knows what items are available to be bought/shipped.

4
Storing
Here the robot travels to an employee and the employee stores the item in the robot. The cloud now knows which item is stored in which cubby in which robot.

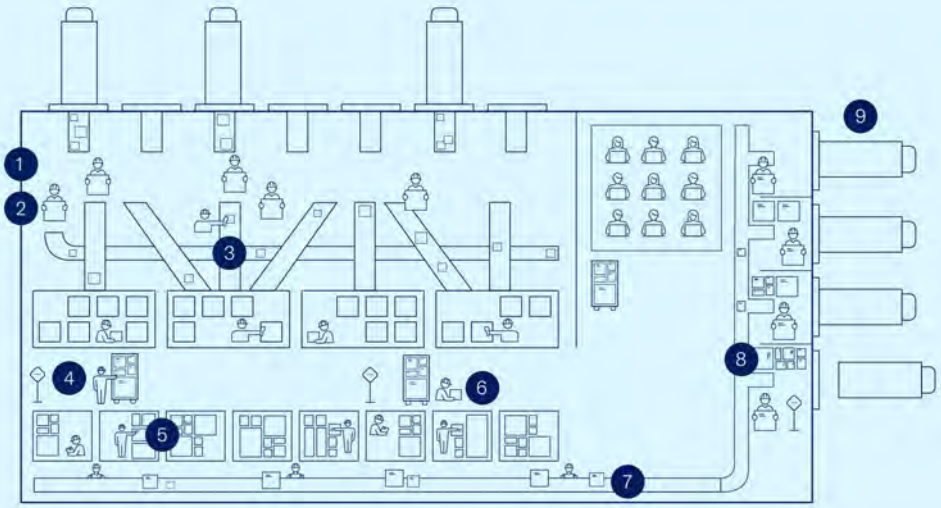
5
Identifying Order
This is all computer/cloud info. Customer orders an item and the cloud identifies where that item is (which cubby in which robot).

6
Picking
The robot travels to the picker. The picker retrieves the item takes the item and the robot travels away.

7
Conveying
The picker sends the item down conveyer belts to be packed and shipped.

8
Packing
Ordered items are packed and labeled for shipping

9
Shipping
Thousands of packages are loaded onto trucks/vans. Delivery vehicles travel to customer homes.



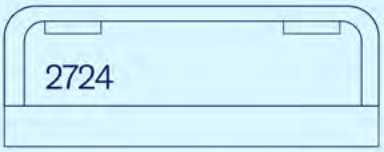
Key roles

- Warehouse Workers
- Software Engineers and Developers
- Cloud Engineers and Analysts
- Data Scientists
- Data Analysts
- Robotics Engineers and Programmers
- Machine Learning Experts
- Electrical Engineers
- Mechanical Engineers

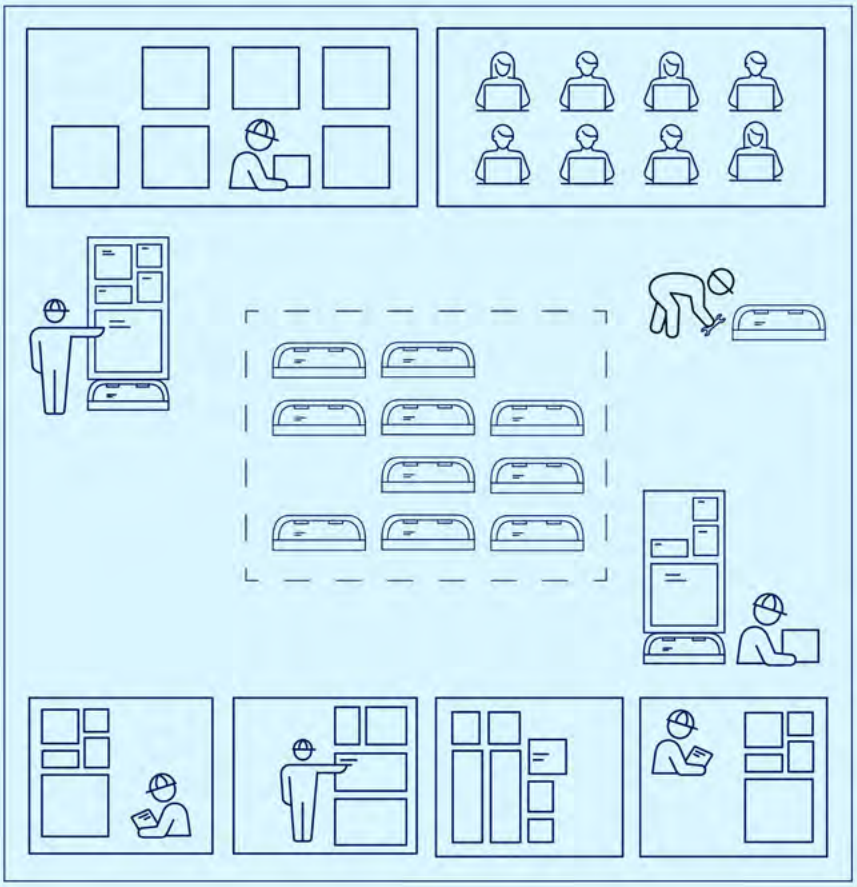
Key moments

1. **Unloading**
   Workers unload large boxes from the semitrucks onto pallets.
2. **Breaking down**
   Large pallets are broken down into smaller sizes that are more manageable for storers to work with.
3. **Identifying for storage**
   This is where the engineers get involved. The employee now scans the item so that the cloud knows what items are available to be bought and shipped.
4. **Storing**
   Here the robot travels to an employee and the employee stores the item in the robot. The cloud now knows which item is stored in which cubby in which robot.
5. **Identifying order**
   This is all computer/cloud info. Consumer orders an item and the cloud identifies where that item is (which cubby in which robot)
6. **Picking**
   The picker retrieves the item and the robot travels away.
7. **Conveying**
   The picker sends the item down conveyer belts to be packed and shipped.
8. **Packing**
   Ordered items are packed and labeled for shipping.
9. **Shipping**
   Thousands of packages are loaded onto trucks/vans. Delivery vehicles travel to customers' homes.

Distribution Center Robots



Robots are responsible for moving and storing products at several points of the identification process.



There are a number of occupations specific to working with and maintaining the robots throughout each step.

- Warehouse Workers
- Data Scientists
- Machine Learning Experts
- Software Engineers and Developers
- Data Analysts
- Electrical Engineers
- Cloud Engineers and Analysts
- Robotics Engineers and Programmers
- Mechanical Engineers

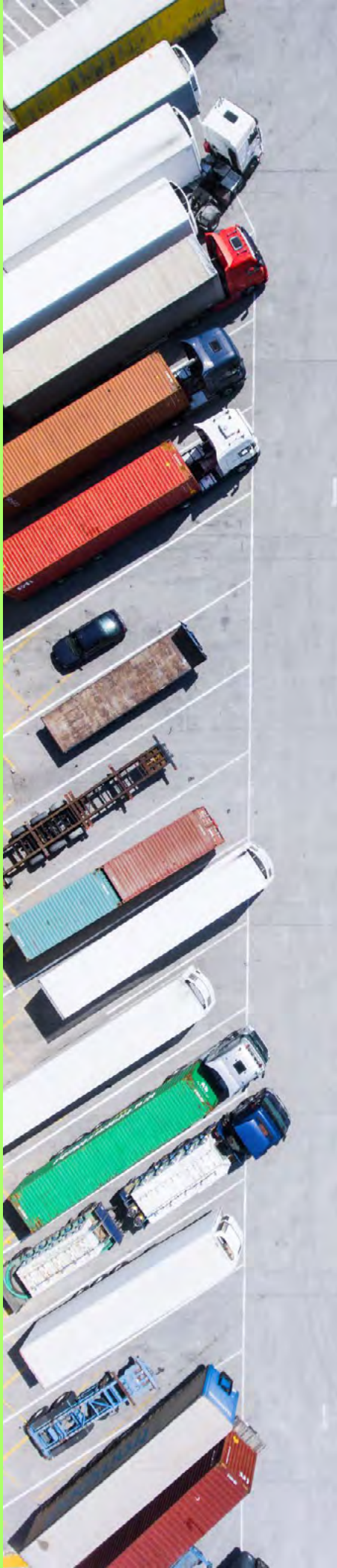
Conclusion

DCs are going to grow in importance in retail and across the economy as online commerce continues to expand. Businesses will build them in more and more communities to better serve their customers. Critics have made sweeping claims about how DCs harm communities, but this often comes from those with a vested interest in maintaining the status quo instead of modernizing and expanding a community's economic base.

An empirical approach that analyzes the full regional economic impact of new DCs shows that they strongly benefit local economies and workforces. It found that on average when a DC employing 3,000 workers opens up in an MSA, it sustains over 5,000 jobs annually over its 20-year life span. In addition, these economic engines produce the following benefits at the MSA level:

- Expand the labor force by more than 3,500 workers.
- Increase personal income by $500 million.
- Grow salaries and wages by $360 million, which results in raising average annual salaries and wages 1.8% each year over the life span of a DC.

Communities of all sizes should welcome a business investing in a new DC in their area if they are seeking to expand growth and opportunity.



Appendix

Appendix 1: REMI Model Framework

PI+ is a structural economic, demographic, and fiscal forecasting and policy analysis model. The following core framework applies to all REMI model builds. The model integrates input-output, computable general equilibrium, econometric and economic geography methodologies.
The model is dynamic, with forecasts and simulations generated on an annual basis and behavioral responses to compensation, price, and other economic factors.

The model consists of thousands of simultaneous equations with a structure that is relatively straightforward. The exact number of equations used varies depending on the extent of industry, demographic, demand, and other detail in the specific model being used. The overall structure of the model can be summarized in five major blocks: (1) Output and Demand, (2) Labor and Capital Demand, (3) Population and Labor Supply, (4) Compensation, Prices, and Costs, and (5) Market Shares. The blocks and their key interactions are shown in Figures 2 and 3.

Figure 2: REMI Model Linkages

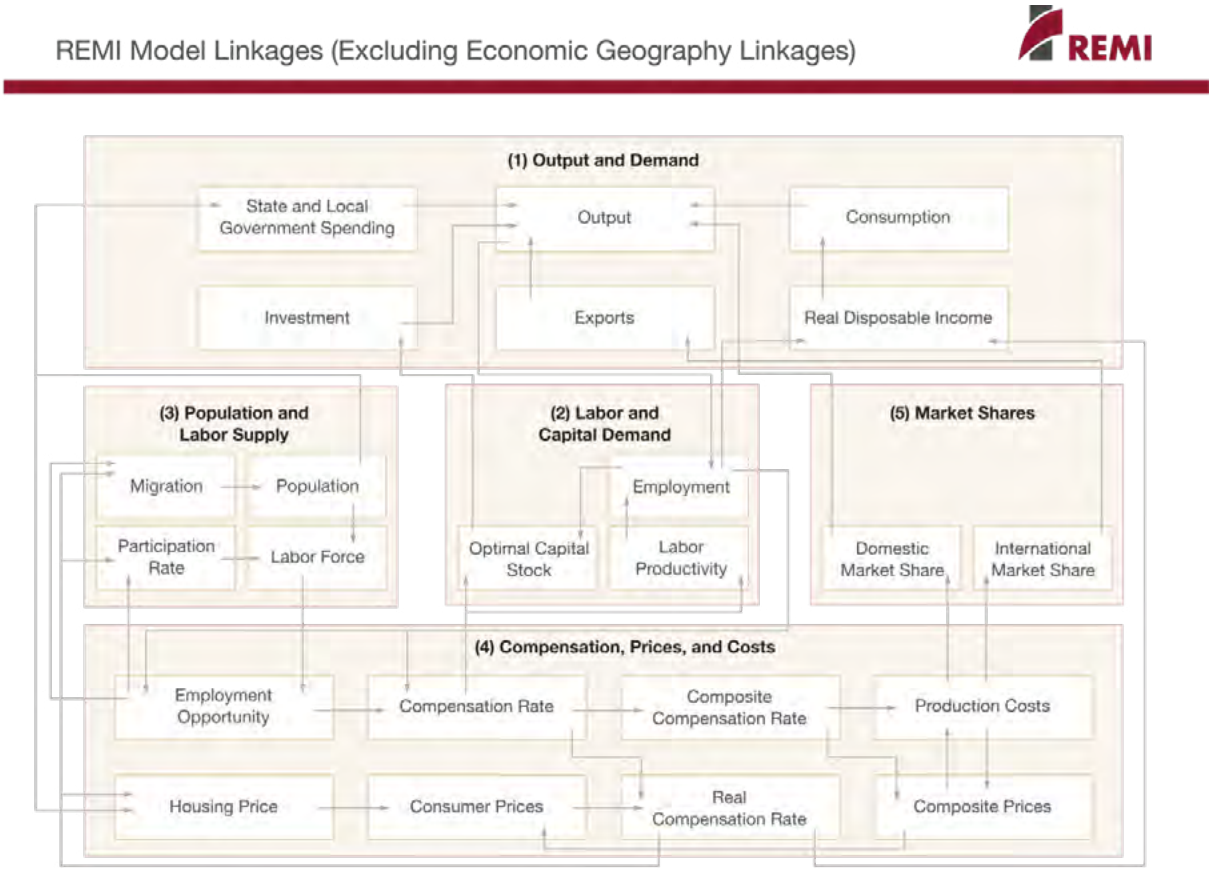
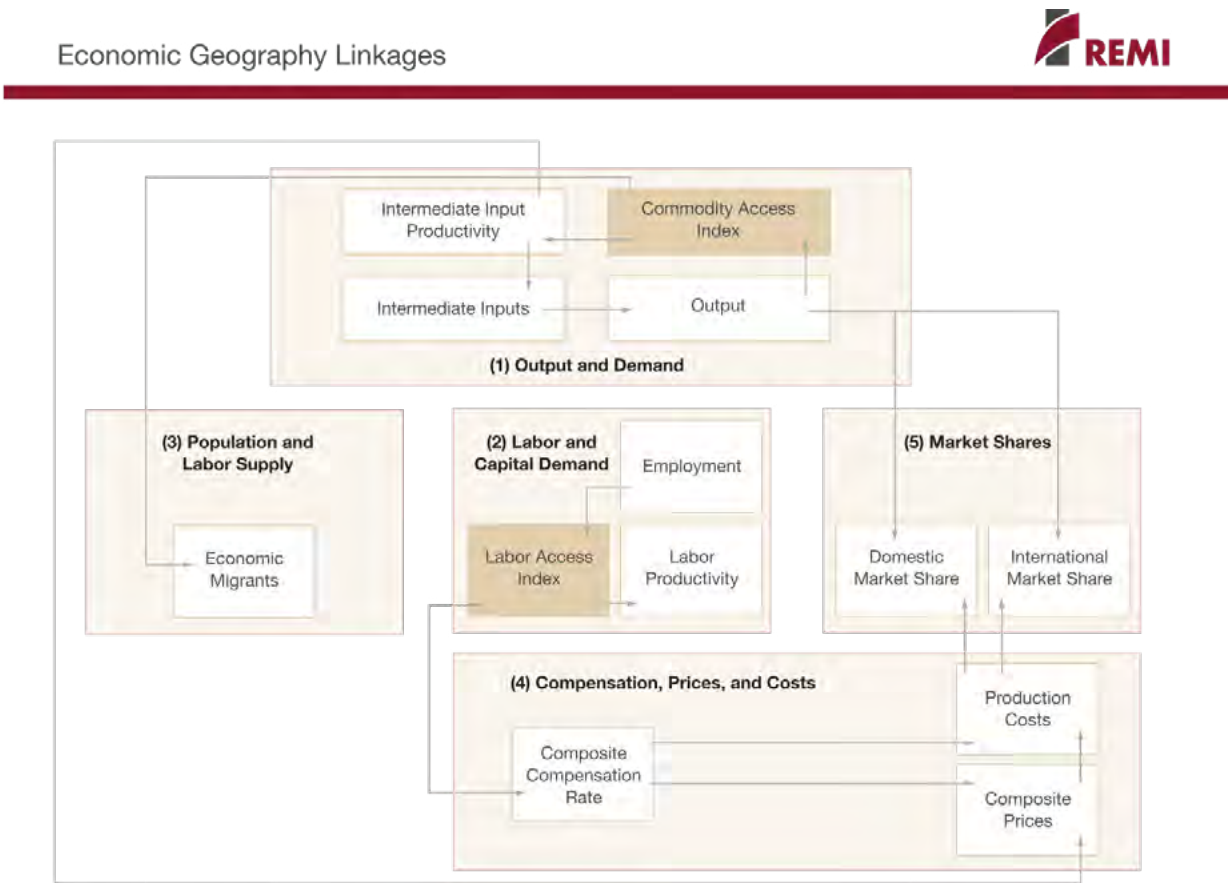


Figure 3: Economic Geography Linkages



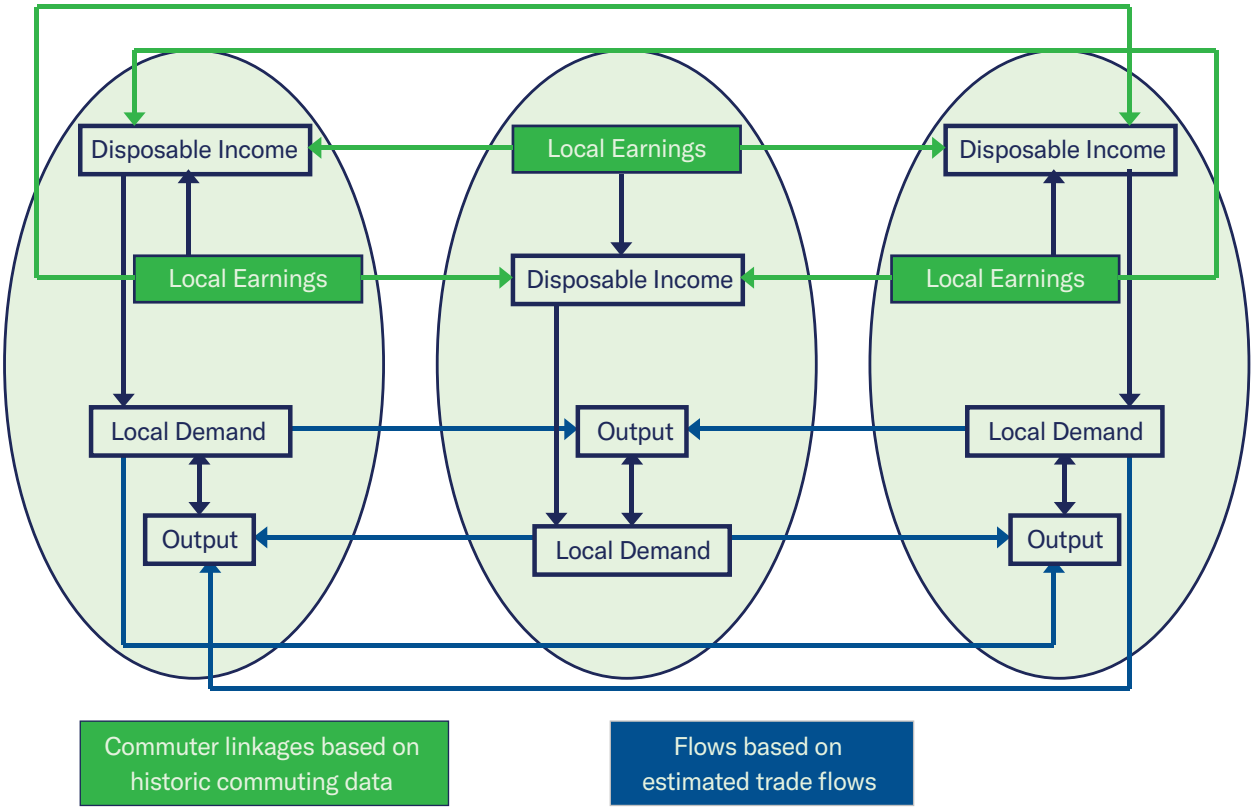
The Output and Demand block consists of output, demand, consumption, investment, government spending, exports, and imports, as well as feedback from output change due to the change in the productivity of intermediate inputs. The Labor and Capital Demand block includes labor intensity and productivity as well as demand for labor and capital. Labor force participation rate and migration equations are in the Population and Labor Supply block. The Compensation, Prices, and Costs block includes composite prices, determinants of production costs, the consumption price deflator, housing prices, and the compensation equations. The proportion of local, inter-regional, and export markets captured by each region is included in the Market Shares block.

Models can be built as single region, multi-region, or multi-region national models. A region is defined broadly as a sub-national area and could consist of a state, province, county, or city or any combination of sub-national areas.

Single-region models consist of an individual region called the home region. The rest of the nation is also represented in the model. However, since the home region is only a small part of the total nation, the changes in the region do not have an endogenous effect on the variables in the rest of the nation.

Multi-regional models have interactions among regions, such as trade and commuting flows. These interactions include trade flows from each region to each of the other regions. These flows are illustrated for a three-region model in Figure 4.

Figure 4: Trade and Commuter Flow Linkages



Multi-regional national models also include a central bank monetary response that constrains labor markets. Models that only encompass a relatively small portion of a nation are not endogenously constrained by changes in exchange rates or monetary responses.

Block 1. Output and Demand

This block includes output, demand, consumption, investment, government spending, import, commodity access, and export concepts. Output for each industry in the home region is determined by industry demand in all regions in the nation, the home region's share of each market, and international exports from the region.

For each industry, demand is determined by the amount of output, consumption, investment, and capital demand on that industry. Consumption depends on real disposable income per capita, relative prices, differential income elasticities, and population. Input productivity depends on access to inputs because a larger choice set of inputs means it is more likely that the input with the specific characteristics required for the job will be found. In the capital stock adjustment process, investment occurs to fill the difference between optimal and actual capital stock for residential, non-residential, and equipment investment. Government spending changes are determined by changes in the population.

Block 2. Labor and Capital Demand

The Labor and Capital Demand block includes the determination of labor productivity, labor intensity, and the optimal capital stocks. Industry-specific labor productivity depends on the availability of workers with differentiated skills for the occupations used in each industry. The occupational labor supply and commuting costs determine firms' access to a specialized labor force.

Labor intensity is determined by the cost of labor relative to the other factor inputs, capital and fuel. Demand for capital is driven by the optimal capital stock equation for both non-residential capital and equipment. Optimal capital stock for each industry depends on the relative cost of labor and capital and the employment weighted by capital use for each industry. Employment in private industries is determined by the value added and employment per unit of value added in each industry.

Block 3. Population and Labor Supply

The Population and Labor Supply block includes detailed demographic information about the region. Population data is given for age, gender, and race, with birth and survival rates for each group. The size and labor force participation rate of each group determines the labor supply. These participation rates respond to changes in employment relative to the potential labor force and to changes in the real after-tax compensation rate. Migration includes retirement, military, international, and economic migration. Economic migration is determined by the relative real after-tax compensation rate, relative employment opportunity, and consumer access to variety.

Block 4. Compensation, Prices and Costs

This block includes delivered prices, production costs, equipment cost, the consumption deflator, consumer prices, the price of housing, and the compensation equation. Economic geography concepts account for the productivity and price effects of access to specialized labor, goods, and services.

These prices measure the price of the industry output, taking into account the access to production locations. This access is important due to the specialization of production that takes place within each industry, and because transportation and transaction costs of distance are significant. Composite prices for each industry are then calculated based on the production costs of supplying regions, the effective distance to these regions, and the index of access to the variety of outputs in the industry relative to the access by other uses of the product.

The cost of production for each industry is determined by the cost of labor, capital, fuel, and intermediate inputs. Labor costs reflect a productivity adjustment to account for access to specialized labor, as well as underlying compensation rates. Capital costs include costs of residential structures and equipment, while fuel costs incorporate electricity, natural gas, and residual fuels.

The consumption deflator converts industry prices to prices for consumption commodities. For potential migrants, the consumer price is additionally calculated to include housing prices. Housing prices change from their initial level depending on changes in income and population density.

Compensation changes are due to changes in labor demand and supply conditions and changes in the national compensation rate. Changes in employment opportunities relative to the labor force and occupational demand change determine compensation rates by industry.

Block 5. Market Shares

The market shares equations measure the proportion of local and export markets that are captured by each industry. These depend on relative production costs, the estimated price elasticity of demand, and the effective distance between the home region and each of the other regions. The change in share of a specific area in any region depends on changes in its delivered price and the quantity it produces compared with the same factors for competitors in that market. The share of local and external markets then drives the exports from and imports to the home economy.

Appendix 2: Jobs Created by Industry

Industry	Salaries and Wages Growth
Utilities	2.0%
Construction	1.6%
Real estate, rental, and leasing	1.4%
State and local government	1.1%
Accomodation and food services	0.9%
Administrative, support, waste management, and remediation services	0.8%
Other services (except public administration)	0.7%
Retail trade	0.7%
Arts, entertainment, and recreation	0.6%
Professional, scientific, and technical services	0.6%
Mining	0.5%
Health care and social assistance	0.5%
Wholesale trade	0.3%
Manufacturing	0.3%
Educational services; private	0.2%
Information	0.1%
Finance and insurance	0.0%
Forestry, fishing, and hunting	0.0%
Management of companies and enterprises	0.0%
Farm	0.0%

*Average per year over 20-year life span of a new Distribution Center

Appendix 3: Jobs Created in the Rest of the Country When a New DC is Built

A New Distribution Center in an MSA Increases Jobs and Incomes in the Rest of the Country			
	Jobs Created	Personal Income Growth	Salaries and Wages Growth
All MSAs	2,218	$433,110,000	$410,916,667
Over 5 million	2,078	$517,491,667	$458,175,000
2.5 million - 5 million	1,925	$442,258,333	$421,475,000
1 million - 2.5 milliion	1,898	$364,400,000	$359,308,333
250,00 - 1 million	2,389	$383,850,000	$390,516,667
Under 250,000	2,800	$457,550,000	$425,108,333
*Average per year over 20-year life span of a new Distribution Center