Metro-to-Metro:
Global and Domestic Goods Trade in Metropolitan America

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Executive Summary

The amount and value of goods that the United States trades every year is astonishing. In 2010, the country moved more than $3 trillion in goods internationally or nearly $8.8 billion, on average, each day. Without a doubt, the trading of physical goods is a major component of the U.S. economy.

However, an exclusive focus on national trade obscures trading relationships among places as different as New York City and Wyoming and overlooks the important variations in metropolitan economies. When policies gauge trade only at the national level—and focus solely on the macroeconomic trends affecting it—they miss extreme regional variety in production, consumption, and goods exchange.

This discussion paper marks the first time metropolitan areas can begin to explore their place in domestic and global goods trade networks. Metropolitan trade volumes track which regions generate the most international trade and the level of trade within the much larger domestic marketplace, resulting in a more comprehensive picture of metropolitan and non-metropolitan trading relationships.

Overall, the analysis shows that the 100 largest American metropolitan areas trade the greatest volume of and the most valuable goods. Products leaving these places are worth more than the products entering them. In particular, metro areas that specialize in the most advanced industrial products, such as electronics and precision instruments, tend to trade goods with an average volume significantly higher than other places. These places are also more globally oriented than the rest of the country.

Unpacking trade balances at the subnational scale also shows that, despite the focus on the national trade deficit, every metro area has trade surpluses in at least one commodity, and almost all in more than one. These surpluses are a promising sign for metro areas looking to boost their trade and production levels, even in places with deep aggregate deficits.

This new measurement of goods exchange at the subnational scale raises important questions about the interrelated nature of modern economies, and it has implications for new approaches to trade and investment. Through this work, we hope to engage a new group of innovative thinkers, practitioners, and policymakers and provide metro leaders with an understanding of their economic starting point on what they trade, where they trade, and how that trade relates to their regional peers. The goal is to enable them to consider new innovative practices from other metro areas and integrate goods movement into their broader transportation plans and economic development programs, especially around exports.

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I. Introduction

As Jane Jacobs famously wrote, "The economic foundation of cities is trade."[1] Without the ability to efficiently and reliably exchange goods, countries and their metropolitan areas would be forced to subsist solely on the resources available within their borders. Although much economic activity in cities serves the needs of the local market, it does not have the same impact on economic growth as trading goods and services outside city boundaries.[2]

To connect cities and metropolitan areas with one another, today's trade networks rely on a complex mix of freight and telecommunications infrastructure, low trade barriers, as well as international business and social networks. This exchange defines the world economy. In the past two decades alone, global goods trade grew by more than 400 percent, dwarfing the growth rate of global gross domestic product (GDP).[3]

Metropolitan areas drive that global trade. In 2012, just 300 metropolitan areas produced 51 percent of global economic output.[4] Developing the unique economic specialties that allow these metro areas to flourish—from chemical and oil facilities in Houston, to machinery and electronics manufacturing in Germany's Ruhr region, to textile and electronics plants in Shenzhen, China—would be impossible without the modern trade networks and supply chains that connect firms and consumers to products made around the world.

Unfortunately, metro area leaders do not have comprehensive information on what they trade, with whom, or how goods are moved from one place to another. Trade statistics are often only presented at the national level and focus solely on country-to-country trade. This not only ignores the primacy of metro-to-metro trade on the global stage, but it also fails to capture all the domestic trade between metro areas within the United States. As a result, metropolitan leaders from the public and private sector are unable to fully understand their place in domestic and global trade networks.

This paper is part of a research and policy series designed to address this deficiency by assessing goods trade at the metropolitan scale.[5] It will help metro leaders better understand their local economies, shape new strategies for freight movement and logistics, and identify trading partners. It uses a unique and comprehensive database to capture all the goods moving in and out of U.S. metropolitan areas, both domestically and beyond. Future reports will describe how goods move between metropolitan areas via different modes of transportation and will uncover the specific trading relationships between U.S. metropolitan areas as well as their global counterparts.

This first report begins with background information on the history of goods trade and its measurement. It reports on subnational goods trade volumes and assesses trends across specific commodities and geographic lines. It also reports on the difference between the amount and type of freight a metropolitan area trades with other places and how this measure relates to local industry profiles. It concludes with a discussion of the possible implications for trade, industry, and public policy.

II. Background

Firms and households in metropolitan areas produce and consume a variety of goods. Endowed with a distinct set of local assets, metro areas use an assortment of inputs—namely land, labor, and capital—to build wealth and drive growth. By gaining access to markets around the world, metropolitan firms specialize in creating different products and exchange them for commodities produced in other regions.[6] Over time, through these physical connections, they bring in new resources and generate additional output, allowing them to expand the scope of their productive activities and meet higher levels of supply and demand.[7]

Transportation enables this trade. An expansive network of multiple modes of transportation serves as a foundation for regional economies.[8] From roads and rails to ports and pipes, this network moves goods between distant places and matches production with consumption.[9] In recent decades, freight's ability to shrink the distance between places through lower costs and greater reliability made possible the global value chains of today.[10]

Trade balances and volumes are vital to understanding these value chains.[11] Essentially, trade balances are a gauge of a nation's comparative advantage relative to various economic forces, ranging

from currency exchange rates to local firms' supplies and demands.[12] Understanding how many goods flow in and out of a particular place can help guide future investments in both industry and infrastructure. With greater exports, for instance, metro areas can benefit from their production specializations and economies of scale to increase output, accelerate job growth, and become more globally competitive.[13]

With the advent of mercantilism in the 16th century, nations began to examine how exports and imports influenced their ability to amass resources, wealth, and power in an imperialist world order. Thomas Mun, along with several European economists and merchants at the time, called on countries to quantify their balance of trade, while promoting exports and minimizing imports as part of a coordinated national strategy.[14]

Other classical economists reoriented this thinking. They argued that trade could lead to mutual gains among nations that developed specializations and engaged actively in exchanging goods, a concept that now serves as a cornerstone for modern economics.[15] These positive gains from trade resulted when nations drew from their unique endowments to produce certain kinds of goods, which they could then exchange for capital and other inputs.[16] The idea of free trade, in other words, took on a new meaning, as nations interacted through a more open exchange of goods.[17]

The nature of global trade further refines how nations view goods movement. Because many countries today rely on service-oriented economies, a deficit in goods trade carries an entirely different meaning than it did in the past. Rather than aim exclusively for a goods trade surplus, countries and their metropolitan anchors also generate value through services. Occupations like product designers, managers, and marketing specialists all create value without actually touching a traded good. Likewise, deficits in particular commodities are often seen as essential ingredients to fuel both service and goods-producing industries. Imports allow all modern industries and economies to function.

For example, America's economic versatility—first in developing a comparative advantage in agricultural exports and then shifting to the manufacture and export of high-value goods—helped the country generate consistent surpluses in international goods trade starting in the 1870s.[18] However, as it transitioned to a more service-oriented economy, the United States saw its overall goods trade balance slide into consistent deficits starting in the 1960s.[19] This is typical in modern times: at the same time the U.S. goods trade deficit grew to $59.3 billion, it also saw its largest service sector surplus, $13.6 billion.[20]

However, these national figures only tell part of the story.

The reality of modern trade is between metropolitan areas.[21] Clusters of firms, workers, and infrastructure form the primary nodes in global value chains, and those assets are located in metropolitan areas. In many cases, these nodes are not merely the points of distribution in the value chains, but also the factories that transform raw commodities into finished products, design products in research labs, and market and sell those products in office spaces.

This is especially true in the United States. The 100 largest metropolitan areas contain two-thirds of the country's population, generate 75 percent of its economic output, and are its centers of advanced manufacturing, innovation, human capital, and technology.[22] They house dense collections of industries that draw from the energies of a skilled workforce and the conveniences offered by their infrastructure networks to create dynamic economies that could not exist in isolation.[23] Large metropolitan areas demonstrate a nation's global fluency and long-term international trading potential.[24]

Yet despite their economic stature, metro areas lack a comprehensive picture of the products they move and trade with each other. This new analysis begins to explore those relationships.

III. Methodology

This report reveals, for the first time, domestic and international goods movement at the metropolitan scale across a variety of measures, including value and weight. It includes all types of goods and commodities, via all modes of transportation. It includes everything from precision surgical equipment on airplanes, to crude oil in pipelines, to consumer products on ships, to scrap metal on trucks, to coal on trains.

To develop these measures, Brookings worked with the Economic Development Research Group

(EDR) to create a unique data set modified from the Freight Analysis Framework (FAF), produced by the U.S. Department of Transportation. The framework provides information on freight movement to, from, and within the United States. It uses 43 different commodity categories and seven transportation modes.[25] However, FAF does not capture origin-destination trade flows between most metropolitan areas, nor does it provide broad country-level detail for international trade.

Therefore, Brookings and EDR reallocated FAF's original flows to metropolitan areas, which are groups of adjacent counties that qualify under core based statistical area (CBSA) definitions. In this report, any flows not within the metropolitan areas are referred to as "non-metropolitan areas" and assigned to specific "state remainders." All trade flows, especially international flows, link trade volumes more directly to domestic and global economic activity. This analysis focuses on where goods are produced and consumed versus the sites of international crossing.[26] The report uses a new "crosswalk" between FAF and Moody's Analytics data to develop a unique set of 15 commodity groups.

This original database offers the most detailed picture of intermetropolitan freight movement to date.[27] It estimates inter-regional freight flows in 2010 by commodity type and transportation mode across 409 domestic areas (361 metropolitan areas and 48 state remainders) and 40 international geographies (18 countries, 11 larger country groups, and 11 continental remainders). Appendix A describes these methods in greater detail.

Given the emphasis on economic production, this report concentrates primarily on measures of *value* rather than *weight*. Value illustrates patterns in the economic worth of individual commodities and their relationship to larger global value chains. Weight relates more closely to the specific transportation modes and ports that help move goods as part of these global value chains and will be the focus of a future report.

Key Terms

Regional Geography: This report subdivides the United States into individual and aggregate regions based on metropolitan area definitions.[28] One group is the *100 largest metropolitan areas*, as measured by population from the 2010 decennial census. The next group is all *other metropolitan areas*, which for this project includes another 261 metropolitan areas.[29] The final group is the remaining parts of the country, referenced as *non-metropolitan areas*.

Goods Trade: The physical exchange of products or commodities between two distinct trading partners. These exchanges encompass the full range of commodities, from the rawest natural resources such as stones to the most advanced manufacturing products such as aerospace equipment.

Trade Volume: The total quantity of goods traded in and out of a particular region. It measures volumes by *value* (in U.S. dollars), *weight* (in tons), and *value per ton* (value divided by weight).

Inflows: The volume of goods a region or metro area purchases from other places, reported in either value or weight. Inflows are subdivided domestically (by domestic destination) and internationally (by foreign origin). *Imports*, as such, refer exclusively to international inflows.

Outflows: The volume of goods a region sells to other regions and countries, reported in either value or weight. Outflows are subdivided domestically (by domestic origin) and internationally (by foreign destination). *Exports*, as such, refer exclusively to international outflows.

Trade Balance: The difference in trade volumes between outflows and inflows. The report describes trade balances across combinations of trade geography and commodity category.

Commodities: This report uses a collection of 15 commodities to better describe the goods that metropolitan areas trade: agricultural products, stones/ores, energy products, chemicals/plastics, wood products, textiles, metals, machinery/tools, electronics, transportation equipment, precision instruments, furniture, waste, mixed freight, and unknown. For more information on these commodity groups, see Appendix A.

Advanced Industries (AI): Industries that invest heavily in research and development and employ a highly skilled workforce. Their tendency is to consume high-value commodities as inputs and to produce high-value goods as outputs. The following commodities are most likely to include AI-produced goods: chemicals/plastics, machinery/tools, electronics, transportation equipment, and precision instruments.[30]

IV. Metropolitan Trade Volumes

Nations have tracked the quantity of goods they trade with each other for centuries, helping to gauge their level of interaction. Yet, those measures often overlook how much nations trade within their borders, or even which regions drive international trade.[31]

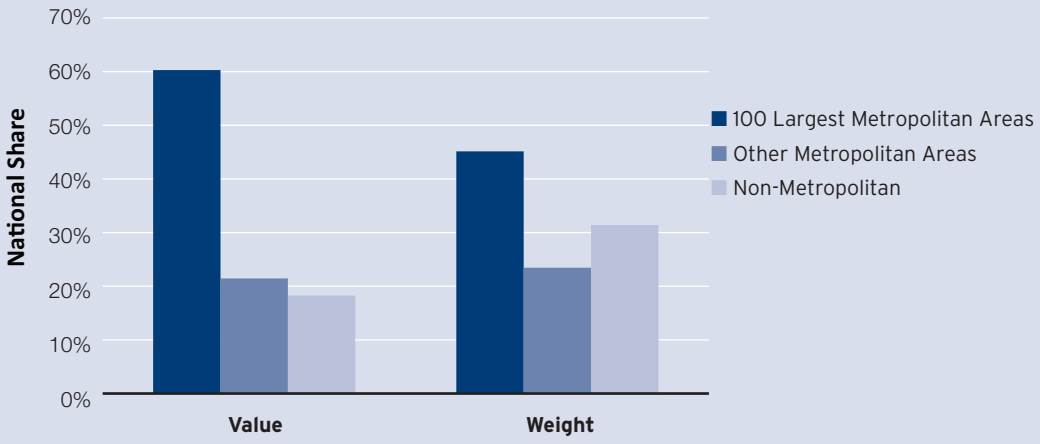
Metropolitan trade volumes offer new insights. They gauge exactly which regions generate the most international trade. It also provides the ability to examine goods exchanged within the much larger domestic marketplace. The ability to report both domestic and international trade creates the statistical bridge to provide a comprehensive picture of metropolitan and non-metropolitan trading relationships.

In 2010, the United States traded more than 17.3 billion tons of freight worth $20.3 trillion domestically and internationally.[32] To put the value in terms of the nation's economy, national output was $13.1 trillion in 2010, meaning the country transported $1.55 in goods for every $1 of overall output. It also means an average day sees more than $55 billion and nearly 47 million tons of goods transported.

The nation's 100 largest metropolitan areas drive those trade numbers. Combined, their total volume is $12.2 trillion and 7.8 billion tons, which represent 60 percent and 45 percent, respectively, of goods traded nationally (Figure 1). Considering these metropolitan areas are the more economically diversified portions of the country, specifically in their concentration of tradable service clusters, these goods trade shares underscore their enormous presence in national production and consumption networks.[33] In contrast, the country's non-metropolitan areas move only 18 percent of freight value and 31 percent of freight weight, while the country's smaller metropolitan areas move 21 percent of value and the lowest weight share (24 percent).

The highest-volume traders are generally the largest metropolitan economies.[34] For example, among the 10 largest goods traders, only one—Detroit—did not also rank in the top 10 by metropolitan GDP (Table 1). Collectively, these 10 markets trade more than one-fifth (22 percent) of all national goods and have larger trade volumes ($4.5 trillion) than the country's entire non-metropolitan portions combined ($3.7 trillion). Their volumes also exceed the nation's entire international trading volume, which was the biggest in the world in 2010.

Figure 1. Total Freight Volumes by Geographic Area, 2010



Source: Brookings analysis of Economic Development Research Group and Census data

Table 1. 25 Largest Metropolitan Goods Traders, by Value and Metro Economy Size, 2010

Metropolitan Area	Trade Volumes			Metropolitan Economy		
	Value ($ mil)	Rank	National Share	GDP ($ mil)	Rank	National Share
New York-Northern New Jersey-Long Island, NY-NJ-PA	$719,962	1	3.5%	$1,114,716	1	8.5%
Los Angeles-Long Beach-Santa Ana, CA	$699,322	2	3.4%	$652,084	2	5.0%
Chicago-Joliet-Naperville, IL-IN-WI	$657,693	3	3.2%	$470,125	3	3.6%
Houston-Sugar Land-Baytown, TX	$511,898	4	2.5%	$352,630	5	2.7%
Dallas-Fort Worth-Arlington, TX	$420,461	5	2.1%	$340,516	6	2.6%
Philadelphia-Camden-Wilmington, PA-NJ-DE-MD	$349,964	6	1.7%	$305,393	7	2.3%
Atlanta-Sandy Springs-Marietta, GA	$336,996	7	1.7%	$244,055	10	1.9%
Detroit-Warren-Livonia, MI	$288,718	8	1.4%	$169,852	15	1.3%
San Francisco-Oakland-Fremont, CA	$243,567	9	1.2%	$295,610	8	2.3%
Boston-Cambridge-Quincy, MA-NH	$236,596	10	1.2%	$284,254	9	2.2%
Minneapolis-St. Paul-Bloomington, MN-WI	$218,903	11	1.1%	$178,601	13	1.4%
San Jose-Sunnyvale-Santa Clara, CA	$209,630	12	1.0%	$163,843	16	1.3%
Phoenix-Mesa-Glendale, AZ	$200,996	13	1.0%	$169,941	14	1.3%
St. Louis, MO-IL	$198,148	14	1.0%	$112,708	21	0.9%
Seattle-Tacoma-Bellevue, WA	$185,324	15	0.9%	$207,390	12	1.6%
Memphis, TN-MS-AR	$184,310	16	0.9%	$55,799	45	0.4%
Columbus, OH	$175,908	17	0.9%	$81,539	32	0.6%
Cincinnati-Middletown, OH-KY-IN	$173,596	18	0.9%	$87,912	30	0.7%
Miami-Fort Lauderdale-Pompano Beach, FL	$169,651	19	0.8%	$229,876	11	1.8%
Washington-Arlington-Alexandria, DC-VA-MD-WV	$169,412	20	0.8%	$376,696	4	2.9%
Riverside-San Bernardino-Ontario, CA	$163,103	21	0.8%	$96,322	25	0.7%
Baltimore-Towson, MD	$162,106	22	0.8%	$128,354	20	1.0%
Kansas City, MO-KS	$162,026	23	0.8%	$95,477	26	0.7%
Indianapolis-Carmel, IN	$149,817	24	0.7%	$89,040	29	0.7%
Cleveland-Elyria-Mentor, OH	$149,443	25	0.7%	$91,313	27	0.7%
Total	**$7,137,551**	**N/A**	**35.2%**	**$6,394,046**	**N/A**	**48.9%**

Source: Brookings analysis of Economic Development Research Group, Census, and BEA data.

The composition of a metropolitan economy is a strong indicator of trade volumes.[35] Metro areas with large economies focused on production and consumption of goods (as opposed to services) generally have higher trade volumes than either population or traditional GDP calculations would suggest.[36] For the 100 largest metro areas, this goods-related composition determines whether they trade more or less than their similarly sized peers. The San Jose metro area, for instance, ranks 31st in population and 16th in the size of its economy, yet its total trade in goods ($209.6 billion) ranks 12th, driven primarily by electronics and precision instruments (Table 1). The situation is similar in New Orleans (46th in population, 26th in freight volume), Greensboro, NC (71st and 44th), and Toledo, OH (81st and 57th). Each of these metropolitan economies specializes in tradable goods—energy, chemicals, and

transportation equipment, respectively—and each, consequently, has higher freight volumes than their populations alone would suggest.

On the flip-side, the Washington, DC, metro area moves $40 billion less in total goods than San Jose despite an overall economy twice as large. This does not mean Washington's economy is weak; rather it specializes in tradable services like consulting and legal affairs rather than tradable goods. Las Vegas, Orlando, and Sacramento are similar.

Houston: Leveraging its Energy Advantage

With the nation's fifth highest GDP, metropolitan Houston draws approximately one-third of its output from industries that produce physical goods. That is the highest total ($112.5 billion in 2010) among all metro areas and is driven by commodities such as energy, chemicals, and machinery.[37]

Transporting $511.9 billion in freight, Houston ranks behind only New York, Los Angeles, and Chicago in total goods volume. Combined, energy products and chemicals/plastics account for more than half its total, while electronics and machinery/tools contribute another 20 percent. Houston's dominance in energy and chemicals, ranging from refined gasoline to plastics and rubber, is fueled by several prominent firms headquartered nearby, such as ConocoPhillips and Marathon Oil, and more than 3,700 energy-related establishments.[38] As a result, Houston's trade in energy products ($164.7 billion) is higher than any other metro area, and more than double the next largest energy trader, Los Angeles ($79.6 billion.)

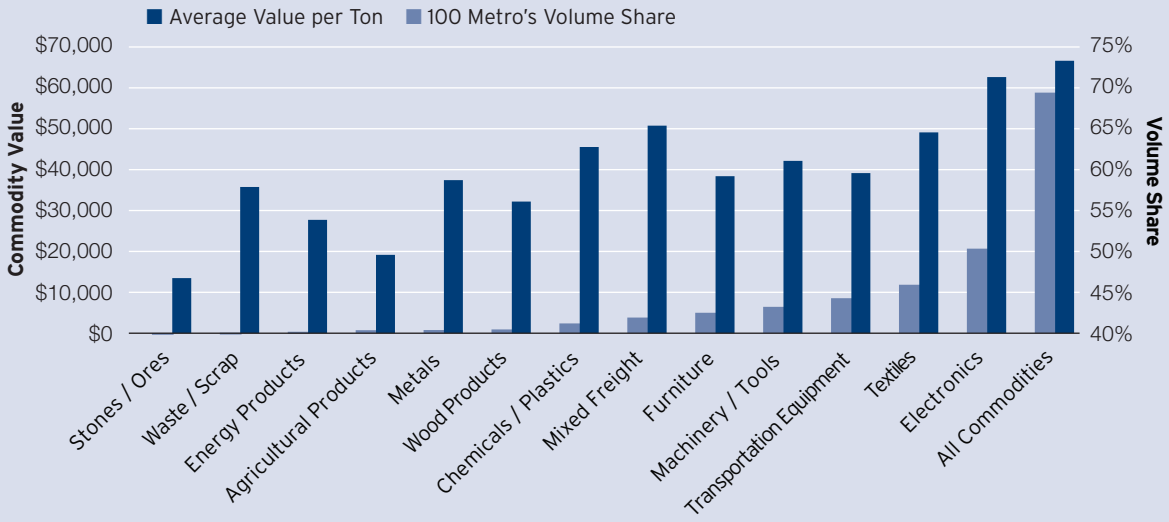
Houston's specialization in energy and manufacturing is even more remarkable in terms of weight, as it transports the most tonnage nationally (539 million tons in 2010), more than New Orleans and Dallas combined. Once again, energy products lead all other goods—accounting for 63 percent of the metro total—followed by chemicals/plastics. As local refineries attract higher volumes of oil and natural gas following the recent shale gas boom, Houston is expected to expand its comparative advantage in the energy sector in coming years.[39] The Port of Houston, likewise, is experiencing a surge in business centered on this movement, spurring additional investment throughout the area to handle more of this heavy freight.[40]

Although metropolitan Houston moves 76 percent of its goods domestically, its concentration in energy production and consumption means it is more globally oriented than other metro areas. Next to electronics, energy products make up the second highest international share—roughly 35 percent by value and weight—among all commodities in the metro area. Houston imports significantly more of these energy commodities than it exports, but those commodities serve as essential inputs for the oil it refines and the chemicals it produces for other markets. Indeed, by building off its energy sector, Houston has grown into a leading exporter of several goods, a position it aims to further strengthen through its international connections.[41]

Regardless of a metro area's economic focus, the average value of its traded goods helps indicate each area's production specialties and consumption preferences. Higher average values of good production suggest an economy less focused on raw materials and more on advanced manufacturing. Consumption demands have a similar effect: higher firm and household incomes create the opportunity to purchase more expensive products. This, in turn, affects the type of infrastructure needed to move those goods (i.e., heavy trucks, freight rail or seaports for bulky products, or airports and smaller trucks for lightweight, expensive items).

The largest metro areas show a clear propensity to produce and consume the country's highest-valued goods (Figure 2), including those related to advanced industries: chemicals/plastics, machinery/tools, electronics, transportation equipment, and precision instruments.[42] Overall, the average value per ton of all goods traded in the United States is $1,170. In the 100 largest metropolitan areas, the average value rises to $1,563 per ton, compared with $680 per ton in the country's non-metropolitan regions. As discussed later, these advanced industries matter because they collectively add more to the economy than is revealed by their respective contributions to productivity, employment, and wages alone.

Figure 2. Commodity Groups: Average Value per Ton and Volume Share by Value, 2010



Source: Brookings analysis of Economic Development Research Group and Census data

Individual metro areas also stand out in the types of valuable goods they trade. Given the specialization in telecommunications products and the presence of firms such as Qualcomm, metropolitan San Diego's traded goods have the highest average value at $3,445 per ton.[43] Other metro areas that specialize in cutting-edge manufacturing such as Hartford, CT (machinery) and Boston (electronics) trade relatively high-value, low-weight goods as well.[44]

Yet as Table 2 shows, not all of the 100 largest metropolitan areas specialize in high-value goods. Metro areas that trade in heavy raw materials such as agriculture (Modesto, CA; Stockton, CA; and Lakeland, FL) or energy products (New Orleans, Houston, and Baton Rouge) all move goods with below-average values. In total, 22 of the 100 largest metropolitan areas traded goods with a lower average value per ton than the national benchmark of $1,170.

In some metro areas, a combination of high- and low-value commodities has the greatest influence on average values. In metropolitan New York, for example, chemicals/plastics are the most traded commodity. But the metro area ranks very high in average values by also trading large volumes of machinery/tools, electronics, and textiles. Birmingham, AL, is the opposite. There, relatively high-value chemicals/plastics are not enough to compensate for trade in lower-value metals and agricultural products.

Although average values are an important measure of the composition and focus of a metro area's industries, they are not an indicator of economic growth patterns. Table 2 shows that Hartford, CT, Providence, RI, and Bridgeport, CT, trade some of the country's most valuable goods. However, they are among the slowest to recover from the recession in the nation. Just because a metro produces high-value goods, does not mean either those industries are growing or, if they are growing, they can offset slower growth rates in other local industries. Interestingly, many metro areas that trade lower-value goods are experiencing much stronger economic recoveries. Houston and New Orleans are notable in this respect, moving some of the least valuable goods while ranking in the top 10 metro areas on the basis of their recoveries.[45]

Table 2. Metropolitan Goods Trade by Value per Ton, 10 Highest and Lowest Values, 2010

Metropolitan Area	Metropolitan Value / Ton	Rank	Commodity with Highest Volume by Value	Commodity Value / Ton
San Diego-Carlsbad-San Marcos, CA	$3,445	1	Electronics	$32,515
Hartford-West Hartford-East Hartford, CT	$3,037	2	Machinery / Tools	$11,046
San Jose-Sunnyvale-Santa Clara, CA	$3,027	3	Electronics	$26,791
Providence-New Bedford-Fall River, RI-MA	$3,027	4	Machinery / Tools	$12,904
Poughkeepsie-Newburgh-Middletown, NY	$2,952	5	Electronics	$22,786
Bridgeport-Stamford-Norwalk, CT	$2,777	6	Machinery / Tools	$8,805
Boston-Cambridge-Quincy, MA-NH	$2,718	7	Electronics	$29,115
Memphis, TN-MS-AR	$2,717	8	Chemicals / Plastics	$10,444
New York-Northern New Jersey-Long Island, NY-NJ-PA	$2,695	9	Chemicals / Plastics	$5,085
Phoenix-Mesa-Glendale, AZ	$2,460	10	Electronics	$35,864
100 Metropolitan Areas Benchmark	**$1,563**	**N/A**	**Chemicals / Plastics**	**$2,828**
National Benchmark	**$1,170**	**N/A**	**Chemicals / Plastics**	**$2,394**
Houston-Sugar Land-Baytown, TX	$950	91	Energy Products	$488
Cape Coral-Fort Myers, FL	$946	92	Machinery / Tools	$4,208
Tampa-St. Petersburg-Clearwater, FL	$942	93	Chemicals / Plastics	$868
Charleston-North Charleston-Summerville, SC	$941	94	Chemicals / Plastics	$2,718
Modesto, CA	$934	95	Agricultural Products	$911
Birmingham-Hoover, AL	$901	96	Chemicals / Plastics	$3,316
Stockton, CA	$892	97	Agricultural Products	$790
Baton Rouge, LA	$789	98	Energy Products	$597
Lakeland-Winter Haven, FL	$771	99	Agricultural Products	$939
New Orleans-Metairie-Kenner, LA	$618	100	Energy Products	$550

Source: Brookings analysis of Economic Development Research Group and Census data

San Jose: Specializing in High-Value Goods

Known as the "Capital of Silicon Valley," metropolitan San Jose is the center of the nation's high-tech hub, and goods-producing tech industries contribute to more than 31 percent ($39.7 billion) of the metro area's total output.[46] The large volume of electronics, precision instruments, and other advanced industrial products make San Jose one of the country's chief engines of high-value commodity trading.

Trade volumes in electronics amount to $102.0 billion, second only to metropolitan Los Angeles ($104.7 billion), and represent 49 percent of San Jose's total goods trade, an enormous concentration in a single category and its associated industries. From Google and Apple to Hewlett-Packard and Cisco Systems, the cluster of high-tech firms and production facilities near San Jose magnifies the importance of computers, networking equipment, and other electronic components transported to and from the area.[47] San Jose also specializes in trading complementary goods, including machinery/tools ($29.5 billion) and precision instruments ($16.0 billion), ranking closely behind Boston in both commodities.

With a focus on advanced industries, metropolitan San Jose is a national center in high-value goods trading. The average good in San Jose trades for more than $3,000 per ton, which exceeds other major electronic production centers such as Phoenix ($2,460) and Austin, TX ($1,990).[48] Even more notable is the fact that San Jose sends out goods worth about $1,550 more, on average, than what it takes in, highlighting its ability to create value on a range of products. Electronics leaving the metro area, for instance, have an average value ($29,120), considerably higher than those that enter it ($24,340). This is likely owing to the area's concentration in advanced manufacturing operations.[49]

San Jose's metropolitan economy is buoyed by its firms' strong connections to global production networks.[50] For example, while San Jose ranks 12th among the 100 largest metro areas in the average value of its domestic goods ($2,190), it is unrivaled in the value of its international goods ($9,420), which are worth almost double those in the next highest metro, Palm Bay, FL ($5,250). Among these international goods, San Jose is the country's foremost exporter of electronics, with a volume ($25.9 billion)that is more than three times as high as that of the next ranking metro area, Dallas ($8.2 billion), reaffirming its status as a globally fluent metro.[51]

Beyond increased production, advances in technology and manufacturing benefit the high-tech industries that generate a majority of the area's trade in goods. At the same time, the steady stream of start-ups and skilled entrepreneurs entering the region cement San Jose's leading role in global value chains, driving trade in the most valuable goods worldwide.

The majority of goods traded in the largest metropolitan areas are traded in the domestic marketplace. Within each of the largest metro areas, domestic trade represents at least two-thirds of total trade. Table 3 shows that some metro areas such as Stockton, CA, Modesto, CA, and Lancaster, PA, along with seven others, all conduct more than 90 percent of their trade within the United States. These 10 markets still trade globally—$60.0 billion, which is more than Pakistan's total international trade—but these volumes are miniscule compared with the $731.9 billion they trade domestically.[52]

While domestic trade constitutes a majority of the goods U.S. metro areas exchange, increased trade with global metro areas remains paramount to boosting U.S. economic health and competitiveness. Exports have driven more than one-half of the growth in economic output since the recession ended.[53] With more than 95 percent of the world's consumers projected to be outside the United States in the coming decade, as well as 80 percent of global economic growth, many U.S. metro areas are moving aggressively to capitalize on this opportunity.

Table 3. Top 10 Domestic and International Trade Volumes, by Total Value and Share of Metropolitan Trade, 2010

Rank	Metropolitan Area	Domestic Trade Volumes ($ mil)
1	Los Angeles-Long Beach-Santa Ana, CA	$598,087
2	New York-Northern New Jersey-Long Island, NY-NJ-PA	$584,962
3	Chicago-Joliet-Naperville, IL-IN-WI	$559,467
4	Houston-Sugar Land-Baytown, TX	$389,577
5	Dallas-Fort Worth-Arlington, TX	$353,714
6	Atlanta-Sandy Springs-Marietta, GA	$299,064
7	Philadelphia-Camden-Wilmington, PA-NJ-DE-MD	$293,321
8	Detroit-Warren-Livonia, MI	$227,083
9	Boston-Cambridge-Quincy, MA-NH	$188,634
10	Minneapolis-St. Paul-Bloomington, MN-WI	$180,461

Rank	Metropolitan Area	International Trade Volumes ($ mil)
1	New York-Northern New Jersey-Long Island, NY-NJ-PA	$135,001
2	Houston-Sugar Land-Baytown, TX	$122,321
3	Los Angeles-Long Beach-Santa Ana, CA	$101,235
4	Chicago-Joliet-Naperville, IL-IN-WI	$98,225
5	San Jose-Sunnyvale-Santa Clara, CA	$75,163
6	Dallas-Fort Worth-Arlington, TX	$66,747
7	San Francisco-Oakland-Fremont, CA	$64,939
8	Detroit-Warren-Livonia, MI	$61,635
9	Philadelphia-Camden-Wilmington, PA-NJ-DE-MD	$56,644
10	Boston-Cambridge-Quincy, MA-NH	$47,962

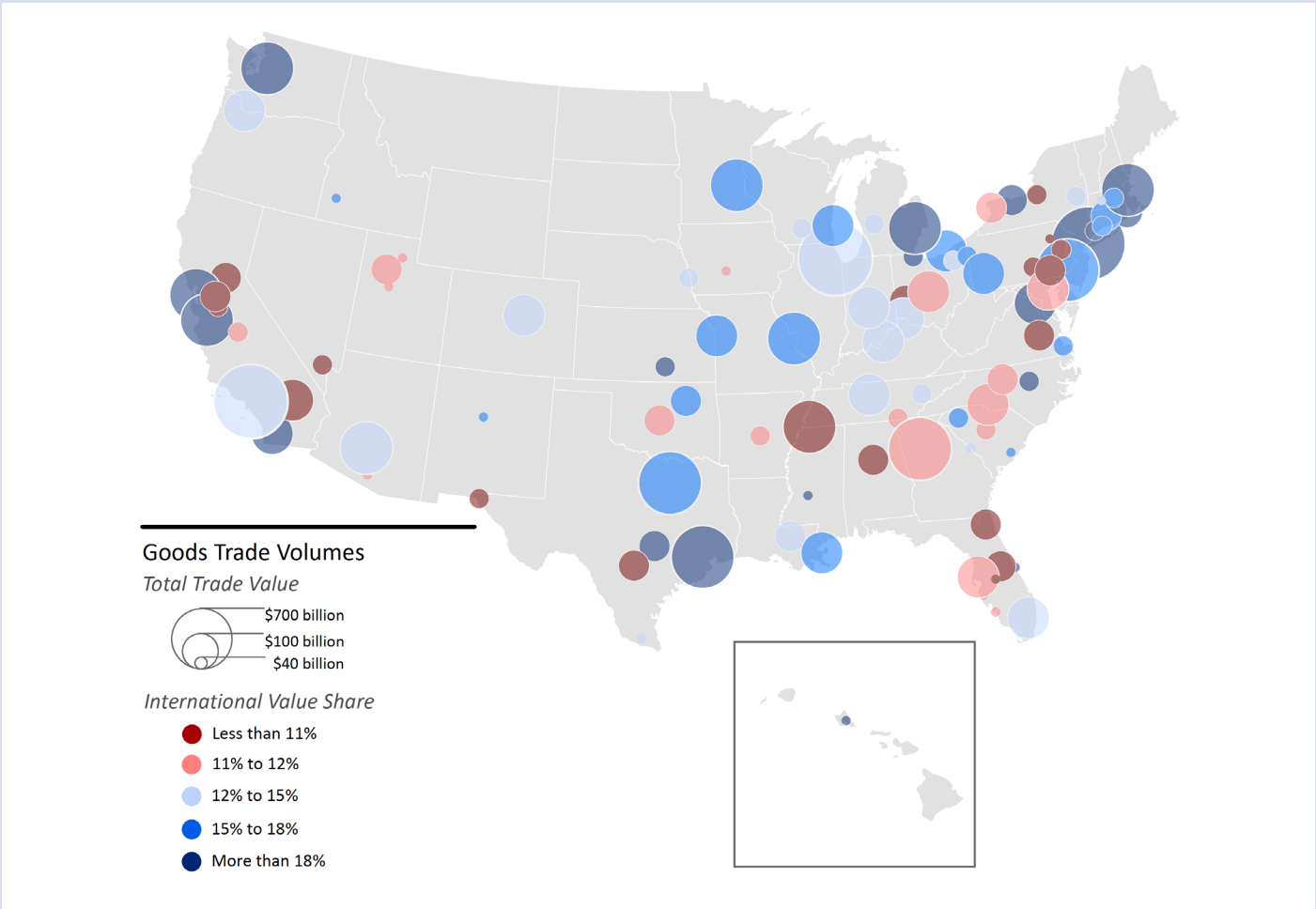
Rank	Metropolitan Area	Domestic Trade Share
1	Stockton, CA	96.2%
2	Modesto, CA	95.7%
3	Lancaster, PA	93.5%
4	Memphis, TN-MS-AR	93.2%
5	Lakeland-Winter Haven, FL	91.9%
6	Jacksonville, FL	91.0%
7	Syracuse, NY	90.6%
8	El Paso, TX	90.5%
9	Orlando-Kissimmee-Sanford, FL	90.4%
10	Richmond, VA	90.1%

Rank	Metropolitan Area	International Trade Share
1	San Jose-Sunnyvale-Santa Clara, CA	35.9%
2	San Francisco-Oakland-Fremont, CA	26.7%
3	Wichita, KS	25.6%
4	Jackson, MS	24.0%
5	Houston-Sugar Land-Baytown, TX	23.9%
6	Washington-Arlington-Alexandria, DC-VA-MD-WV	23.4%
7	Poughkeepsie-Newburgh-Middletown, NY	22.4%
8	Honolulu, HI	22.3%
9	Austin-Round Rock-San Marcos, TX	22.3%
10	Bridgeport-Stamford-Norwalk, CT	22.0%

Source: Brookings analysis of Economic Development Research Group and Census data.

Between 1990 and 2010, U.S. international trade volumes increased by more than 250 percent in inflation-adjusted terms, far surpassing the rate of increase in domestic economic growth.[54] International goods trade now exceeds $3.0 trillion in value and 1.8 billion tons in weight.[55] As value chains continue to extend across the globe, and emerging countries continue to increase their demand for U.S. goods, it is reasonable to expect these volumes and shares will to continue to grow. Today, 15 percent of total U.S. goods trade is international by value and 10 percent by weight.[56]

Figure 3. Total Goods Trade Volumes and International Share, 100 Metropolitan Areas, 2010



Source: Brookings analysis of Economic Development Research Group and Census data.

The 100 largest metro areas are responsible for the vast majority of the nation's international trade, over 63 percent, as well as the highest valued trades. International goods in these metro areas are typically worth $1,934 per ton, exceeding the average value of international goods in non-metropolitan areas ($1,125 per ton) by 72 percent and other metropolitan areas ($1,557 per ton) by 24 percent. In 84 of the 100 metro areas, internationally traded goods carried a higher average value than domestically traded goods.

With a propensity to trade more valuable commodities, the 100 largest metro areas have a clear advantage in trading high-end goods. Internationally, in particular, they trade the majority of the nation's most valuable commodities: precision instruments (77 percent); electronics (74 percent); machinery/tools (63 percent); and transportation equipment (61 percent).[57]

A handful of metropolitan areas are also heavily oriented toward international trade overall. In 39 of the 100 largest metro areas, the international share of goods trade exceeds the national average (Figure 3). These metro areas range from large international traders such as New York, Houston, and San Jose—all of which rank in the top five by total international volume—to smaller metro areas such as Jackson, MS, Honolulu, HI, and Tulsa, OK, which have relatively low trade volumes despite being more globally oriented than the rest of the country. Although not necessarily easy, metro areas looking to expand their international presence should take note of their unique local industrial traits and network with peers that already trade at higher shares in the international space.

From Tucson to Atlanta: A Measure of Trading Specialization

How can metro areas determine whether they are a specialized or balanced trader? One method to determine "specialization" is a combination of location quotients (LQs) and standard deviations (SD). LQs are a way to measure how a commodity's share of metropolitan trade volumes relates to the national average: if it is higher than average, the LQ exceeds 1. The higher the standard deviation in LQ, the more specialized a particular metro is in trading one or more particular goods.

The most specialized trader is Tucson, whose major commodity is stones/ores. Tucson's mining-related trade, which ranges from operating mines to the city's annual gem show, makes up 8.8 percent of the metro area's total traded value, far exceeding the national average of 0.4 percent. These trade levels point to an enormous mining industry, whose share of metro GDP is larger in Tucson that it is in any other metro area in the country.[58] On the other end, Tucson trades at below-average levels in many other commodities, including energy products, agricultural products, and transportation equipment. Other metro areas with specializations in low-value commodities include Salt Lake City (stones/ores), New Orleans (energy products), and Youngstown, OH (metals).

Other highly specialized markets focus on more valuable products. Metropolitan Austin is a prime example with a 4.96 LQ in electronics but below-average shares in other high-value commodities such as textiles, transportation equipment, and machinery/tools. Not only do major firms such as Dell help Austin move large volumes of electronic goods, but they also drive Austin's innovation-rich economy.[59] Other metro areas with a specialization in high-value commodities include Detroit (transportation equipment), Greensboro, NC (furniture), and Palm Bay, FL (precision instruments).

The most balanced traders, by comparison, are large, diverse economies: Chicago, Philadelphia, and Atlanta. Each metro area has one commodity with an LQ above 1.25—metals in Chicago, textiles in Philadelphia, and chemicals/plastics in Atlanta—but these three metro economies are also involved in a wide range of production and consumption activities. Other metro areas with balanced trading profiles are Dallas, San Antonio, and Jacksonville, FL.

These metrics can serve as warnings to metro areas in need of firm or industrial diversification. For example, what would happen to New Orleans' economy and trading patterns if a major oil-related firm like Tidewater, Inc., moved elsewhere along the Gulf Coast, or if Dell moved out of Austin? Is there a big enough industry cluster to compensate for such losses, or the potential to build other industries that would become the metro's new trading anchors? These questions are for local leaders to answer—but trading specialization statistics help reveal which markets should consider them.

V. Metropolitan Trade Balances

The "national trade balance" in goods and services is a familiar economic measure. Media outlets regularly report the difference between exports (considered positive) and imports (considered negative.) In this way, the U.S. runs an international goods trade deficit that is easily the world's largest, far exceeding the second-largest out of the United Kingdom.[60]

While these accounts are important and can highlight which commodities contribute most to the national deficit, they cannot indicate which metropolitan areas actually trade those products both internationally and within American borders.[61]

In short, national trade balances fail to capture the economic variability in a country as big as the U.S.

This section analyzes metropolitan trade balances. It identifies which areas of the country generate surpluses and deficits, and which commodities trend towards each side of the balance ledger. In the process, it adds nuance to more traditional national goods trade measures.

In considering these new metropolitan trade balances, it is important to understand that not all commodities are meant to be sold at a surplus, particularly for many land-intensive natural resources. Geography-centered trade and commodity theories, such as the Von Thünen model to the new economic geography, made popular through Paul Krugman's work, all suggest large population centers rely on less-populated areas to satisfy many of their natural resources demands.[62]

In particular, the 100 largest metro areas frequently purchase greater amounts of commodities such as textiles, agricultural, and wood products than they sell. Relative to their outflows, these large inflows are to be expected for the simple fact that they serve as the critical inputs to sustain advanced metro economies.

The largest net inflow ($237.4 billion) is in energy products—including coal, crude petroleum, refined oils, and liquid natural gas—given what major metro areas require to power homes, factories, and most every element of their built environment. More than one-half of this energy deficit—$160.8 billion—is in international trade. This is one reason why the U.S. shale gas boom can have a sizable impact on international capital flows and why metro areas' continued investments in local renewable energy sources can create more energy self-sufficiency.

In contrast, the 100 largest metro areas export more advanced industry (AI) commodities than they import. They trade the five AI commodities—chemicals/plastics, machinery/tools, electronics, transportation equipment, and precision instruments—at a $52 billion surplus (both domestic and international).

In fact, across all five AI commodities, 47 metro areas generate an overall surplus, moving out more of these goods than they take in. Los Angeles is the clear leader, with an aggregate AI trade surplus of $72.2 billion stemming from its diversified AI economy. Los Angeles' manufacturing base generates a $10 billion trade surplus in four of the five commodities. Five other metro areas exceed $20 billion in AI surplus: Chicago ($44 billion), Houston ($32 billion), Memphis ($27.2 billion), Minneapolis ($22.6 billion), and New York ($20.8 billion).

Another 34 metro areas run a surplus in at least one of the five AI commodities, including some of the biggest single commodity surpluses (Table 4). For example, Seattle's surplus of $9.5 billion in transportation equipment reflects its aerospace specialty, often symbolized by Boeing's local operations. Philadelphia and Phoenix each create more than $4 billion in net value in machinery/tools and electronics, respectively.

These AI balances point to global economic opportunities for U.S. metro areas. Domestic AI surpluses prove the strength of the U.S. marketplace, in that metro areas are developed enough to afford the related industries' expensive products. As the planet's emerging economies continue to grow, their increased incomes and advancing economic development cycles will make domestic AI products more attractive. Just as important, domestic surpluses prove that U.S. metro areas already possess the manufacturing foundation to meet increasing global AI demands.

Table 4. Largest Surpluses in Advanced Industry-Related Commodities, 100 Largest Metropolitan Areas, 2010

Metropolitan Area	Commodity	Surplus ($ billion)	Surplus Rank	Related Industry LQ
Houston-Sugar Land-Baytown, TX	Chemicals / Plastics	$33,887.8	1	1.90
Memphis, TN-MS-AR	Chemicals / Plastics	$32,166.0	2	0.61
Chicago-Joliet-Naperville, IL-IN-WI	Chemicals / Plastics	$31,471.1	3	0.91
Detroit-Warren-Livonia, MI	Transportation Equipment	$30,178.6	4	3.96
New York-Northern New Jersey-Long Island, NY-NJ-PA	Chemicals / Plastics	$28,066.8	5	0.63
Los Angeles-Long Beach-Santa Ana, CA	Transportation Equipment	$22,591.2	6	0.64
Baton Rouge, LA	Chemicals / Plastics	$20,057.1	7	5.09
Austin-Round Rock-San Marcos, TX	Electronics	$19,635.0	8	6.18
Los Angeles-Long Beach-Santa Ana, CA	Electronics	$19,425.9	9	1.44
San Diego-Carlsbad-San Marcos, CA	Electronics	$18,393.6	10	2.65
Los Angeles-Long Beach-Santa Ana, CA	Machinery / Tools	$15,574.5	11	0.67
San Antonio-New Braunfels, TX	Chemicals / Plastics	$13,805.6	12	0.35
Minneapolis-St. Paul-Bloomington, MN-WI	Precision Instruments	$13,393.1	13	3.94
San Jose-Sunnyvale-Santa Clara, CA	Electronics	$11,833.7	14	17.03
Portland-Vancouver-Hillsboro, OR-WA	Electronics	$11,609.3	15	23.69
Los Angeles-Long Beach-Santa Ana, CA	Precision Instruments	$10,641.3	16	2.92
Greensboro-High Point, NC	Chemicals / Plastics	$10,581.1	17	3.04
Cincinnati-Middletown, OH-KY-IN	Machinery / Tools	$10,183.2	18	1.12
Seattle-Tacoma-Bellevue, WA	Transportation Equipment	$9,464.4	19	5.29
Nashville-Davidson--Murfreesboro--Franklin, TN	Electronics	$8,747.8	20	1.73
Minneapolis-St. Paul-Bloomington, MN-WI	Machinery / Tools	$8,569.1	21	1.32
Providence-New Bedford-Fall River, RI-MA	Machinery / Tools	$8,514.8	22	1.47
Wichita, KS	Transportation Equipment	$8,319.9	23	8.60
San Jose-Sunnyvale-Santa Clara, CA	Precision Instruments	$7,857.0	24	3.85
Cleveland-Elyria-Mentor, OH	Machinery / Tools	$7,813.6	25	2.03
Columbus, OH	Chemicals / Plastics	$7,469.1	26	0.59
Boston-Cambridge-Quincy, MA-NH	Precision Instruments	$7,139.6	27	3.46
Dallas-Fort Worth-Arlington, TX	Machinery / Tools	$6,948.7	28	0.80
Dallas-Fort Worth-Arlington, TX	Chemicals / Plastics	$6,878.2	29	0.95
Orlando-Kissimmee-Sanford, FL	Chemicals / Plastics	$6,876.2	30	0.16
Chicago-Joliet-Naperville, IL-IN-WI	Machinery / Tools	$6,660.3	31	1.50
New York-Northern New Jersey-Long Island, NY-NJ-PA	Precision Instruments	$6,457.0	32	0.57
Milwaukee-Waukesha-West Allis, WI	Machinery / Tools	$6,444.3	33	2.62
Memphis, TN-MS-AR	Precision Instruments	$6,386.1	34	1.70
Phoenix-Mesa-Glendale, AZ	Chemicals / Plastics	$6,054.5	35	0.29
Philadelphia-Camden-Wilmington, PA-NJ-DE-MD	Chemicals / Plastics	$5,976.3	36	0.88
Chicago-Joliet-Naperville, IL-IN-WI	Transportation Equipment	$5,754.9	37	0.17
New Orleans-Metairie-Kenner, LA	Chemicals / Plastics	$5,700.3	38	1.56
Houston-Sugar Land-Baytown, TX	Machinery / Tools	$5,446.0	39	1.70
Dayton, OH	Transportation Equipment	$5,302.2	40	1.04
St. Louis, MO-IL	Transportation Equipment	$4,825.2	41	1.49
Oxnard-Thousand Oaks-Ventura, CA	Electronics	$4,814.7	42	4.01
Oxnard-Thousand Oaks-Ventura, CA	Chemicals / Plastics	$4,796.3	43	2.04
Phoenix-Mesa-Glendale, AZ	Electronics	$4,713.3	44	2.80
Boston-Cambridge-Quincy, MA-NH	Electronics	$4,571.2	45	2.89
Columbus, OH	Transportation Equipment	$4,511.4	46	0.88
Philadelphia-Camden-Wilmington, PA-NJ-DE-MD	Machinery / Tools	$4,495.6	47	0.50
Houston-Sugar Land-Baytown, TX	Transportation Equipment	$4,403.1	48	0.14
Hartford-West Hartford-East Hartford, CT	Transportation Equipment	$4,322.9	49	2.26
Cincinnati-Middletown, OH-KY-IN	Transportation Equipment	$4,241.5	50	1.14
Chicago-Joliet-Naperville, IL-IN-WI	Electronics	$4,181.1	51	0.90
Los Angeles-Long Beach-Santa Ana, CA	Chemicals / Plastics	$3,932.4	52	0.49
Hartford-West Hartford-East Hartford, CT	Chemicals / Plastics	$3,611.7	53	0.31
Rochester, NY	Chemicals / Plastics	$3,540.1	54	2.15
Lancaster, PA	Machinery / Tools	$3,509.2	55	1.72
Buffalo-Niagara Falls, NY	Chemicals / Plastics	$3,499.4	56	1.23
Memphis, TN-MS-AR	Machinery / Tools	$3,313.1	57	0.89
Grand Rapids-Wyoming, MI	Transportation Equipment	$3,253.0	58	2.34
Bridgeport-Stamford-Norwalk, CT	Chemicals / Plastics	$3,148.3	59	0.89
Raleigh-Cary, NC	Chemicals / Plastics	$3,143.4	60	1.27

Source: Brookings analysis of Economic Development Research Group and Census data.

Chicago: Achieving Balanced Trade through Advanced Industries

A traditional Midwest powerhouse of production, metropolitan Chicago is home to a variety of industries and infrastructure assets that connect it to the global marketplace. Although Chicago serves as an international center of finance and commerce, the metropolitan area maintains strength in advanced manufacturing and freight coordination, developing a co-location that helps contribute more than$65 billion annually to its gross regional product.[63] The proximity of factories, ports, warehouses, rail lines, and related establishments gives Chicago a strategic advantage during the production process, making it easier to add value through specialization, benefit from a large labor pool, and directly access other markets.[64] With a focus in machinery, metals, and chemicals, Chicago operates at an enormous scale of production and is relatively balanced in its goods trade.

Unlike other metro areas that move large volumes of freight and have significantly higher inflows than outflows—such as New York, Atlanta, and Phoenix—Chicago sells almost as much as it purchases externally. Chemicals, particularly pharmaceuticals, are its lead commodity in this respect, with a $31.5 billion surplus, followed by metals ($12.1 billion), machinery/tools ($6.7 billion), and transportation equipment ($5.8 billion). Its surplus in all four goods ranks in the top 10 metro areas nationally, neck-in-neck with industrial hubs such as Houston in chemicals ($33.9 billion) and Pittsburgh in metals ($12.5 billion). Indeed, its diversity in business, represented by such firms as Illinois Tool Works, Abbott Laboratories, and Navistar International, solidifies the area's standing as a global economic force and heightens its appeal to customers beyond its borders.[65]

To fuel this production and sustain its population, Chicago takes in a broad range of commodities, from energy products to textiles and agriculture. This dependence mirrors metro areas like Los Angeles and Philadelphia that must absorb the necessary consumer products for survival and intermediate inputs for value creation. In much the same way, Chicago's role in global value chains becomes increasingly clear through the massive amount of heavy goods it moves in versus those that it moves out. For example, by bringing in more fuel oils, metallic ores, and wood products than it sends out, Chicago is able to burn, refine, and transform these heavy, raw goods into more valuable finished products.

Domestically, Chicago maintains the fifth highest trade surplus ($25.3 billion) among all metro areas, largely driven by its specialties in chemicals and metals. Internationally, it mostly relies on energy and electronic imports to propel this economic growth, similar to many other metro areas. Moreover, to facilitate the movement of all these goods, Chicago's numerous railroads, highways, and ports—led by O'Hare and Midway International Airports—promote its international accessibility and add to its global fluency.[66]

Through efforts such as Retrofit Chicago, policymakers have taken additional steps to further the metro area's competiveness in global value chains. Efforts are underway to promote the area's energy efficiency and seek alternative energy sources.[67] At the same time, policymakers remain steadfast in their commitment to boost exports.[68] Investments in advanced manufacturing are critical to this strategy, which can help complement one of the major commodities—precision instruments—in which Chicago has an international surplus.[69]

Chicago is well-positioned for global goods trade as it continues to leverage its vast number of productive industries. Remaining a primary freight hub for transporting large volumes of goods, the foundation is set for the metro area to strengthen its existing domestic connections and expand its international trade through export-led growth.

Given the variety of their economic specialties, 87 of the 100 metropolitan areas also run a trade surplus in at least two other types of commodities (Table 5).[70] For example, Fresno, CA, is well known for its Central Valley agriculture and registers a $4.1 billion surplus in agricultural products. But Fresno also has a positive trade balance in textiles ($2.4 billion) and mixed freight ($2.4 billion), underscoring its industrial diversity. Buffalo, NY, conducts major surplus trade in metals ($3.1 billion) and energy and agricultural products ($1.8 and $1.3 billion, respectively). Grand Rapids, MI, has one of the country's biggest surpluses in furniture ($2.3 billion) and also trades wood products at a surplus ($0.9 billion).

Even a surplus in only one commodity is important. Omaha's $5.6 billion surplus in agricultural products, for instance, represents a major source of local value creation and jobs. Charleston, SC, likewise, has a $2.6 billion surplus in metals. Surprisingly, among the 11 metros that have just one surplus commodity, waste/scrap represents the good that most commonly brings new value into these areas. While 'waste' may conjure images of landfills, these surpluses are derived from the valuable byproducts of industrial processes, including scrap metal, paper, and glass.[71]

Table 5 shows that among other non-AI commodities, several metro areas produce a surplus in "mixed freight," which includes a range of wholesale and retail items, such as food, hardware, and office supplies.[72] Major distribution centers, including Dallas and Memphis, are among the leading metro areas in this commodity.[73] Some areas also benefit from large wholesale operations linked to particular firms or markets; Lancaster and Allentown, PA, for instance, are ideally situated near Philadelphia and New York. The location of the metros specializing in mixed freight trade has significant implications for the logistics industry and for freight planning, which will be addressed in future reports.

Some metro areas have trade surpluses in both AI and other commodities. Metropolitan Los Angeles, for example, has trade surpluses in textiles ($13.5 billion) and in all five AI industries, as does Indianapolis, which is one of the few large metro areas with a surplus in wood products ($2.2 billion) to join its large surplus ($2.5 billion) in precision instruments. Pittsburgh generates a $12.5 billion surplus in metals. Yet it also has started to expand its high-tech sector, with important contributions from local anchor institutions such as Carnegie Mellon.[74] In part as a result, Pittsburgh now generates a $0.4 billion surplus in precision instruments.

Finally, it's worth addressing a critical question: how do metropolitan areas offset trade deficits in particular commodities? Some metro areas use their surpluses in other traded goods to pay for these products, but they also use tradable services. These include a range of occupations, from financiers and product designers to hotel managers and professional athletes. When service firms and workers sell their products to outside markets, they bring new income to a metropolitan area. The United States already runs an international surplus in tradable services—primarily driven by services exported from the 100 largest metropolitan areas—and there is every reason to believe the same is occurring on the domestic side.[75] These services help fund inflows, and in some places may be enough to offset local goods deficits. Unfortunately, there are no metro measures for services trade.

Table 5. Largest Surpluses in Non-Advanced Industry-related Commodities, 100 Largest Metropolitan Areas, 2010, and Industry Concentration

Metropolitan Area	Commodity	Surplus ($ billion)	Surplus Rank	Related Industry LQ
New Orleans-Metairie-Kenner, LA	Energy Products	$28,892.1	1	12.15
New York-Northern New Jersey-Long Island, NY-NJ-PA	Textiles	$13,546.7	2	0.94
Los Angeles-Long Beach-Santa Ana, CA	Textiles	$13,491.1	3	2.27
Los Angeles-Long Beach-Santa Ana, CA	Mixed Freight	$13,432.0	4	1.01
Pittsburgh, PA	Metals	$12,523.0	5	3.22
Chicago-Joliet-Naperville, IL-IN-WI	Metals	$12,142.4	6	1.72
Salt Lake City, UT	Metals	$9,060.9	7	5.17
Stockton, CA	Mixed Freight	$8,577.7	8	1.11
Milwaukee-Waukesha-West Allis, WI	Mixed Freight	$7,272.4	9	0.91
Dallas-Fort Worth-Arlington, TX	Mixed Freight	$7,159.7	10	1.18
Syracuse, NY	Mixed Freight	$6,222.2	11	1.07
Columbus, OH	Mixed Freight	$5,654.5	12	0.88
Omaha-Council Bluffs, NE-IA	Agricultural Products	$5,558.9	13	1.57
Oklahoma City, OK	Energy Products	$5,513.1	14	5.15
Chicago-Joliet-Naperville, IL-IN-WI	Mixed Freight	$5,435.3	15	1.08
Greensboro-High Point, NC	Textiles	$5,377.7	16	6.02
Knoxville, TN	Mixed Freight	$5,197.9	17	1.10
Portland-Vancouver-Hillsboro, OR-WA	Mixed Freight	$4,382.8	18	0.92
Denver-Aurora-Broomfield, CO	Energy Products	$4,288.6	19	1.36
Little Rock-North Little Rock-Conway, AR	Mixed Freight	$4,265.4	20	1.29
Columbia, SC	Mixed Freight	$4,264.8	21	0.89
New Haven-Milford, CT	Metals	$4,135.5	22	0.92
Lancaster, PA	Mixed Freight	$4,125.4	23	1.34
Fresno, CA	Agricultural Products	$4,090.6	24	4.60
Atlanta-Sandy Springs-Marietta, GA	Mixed Freight	$4,082.1	25	1.36
Oklahoma City, OK	Mixed Freight	$4,013.8	26	0.79
Memphis, TN-MS-AR	Mixed Freight	$3,895.1	27	1.11
Indianapolis-Carmel, IN	Mixed Freight	$3,795.9	28	0.92
Philadelphia-Camden-Wilmington, PA-NJ-DE-MD	Mixed Freight	$3,764.9	29	0.94
Youngstown-Warren-Boardman, OH-PA	Metals	$3,694.3	30	9.08
Denver-Aurora-Broomfield, CO	Mixed Freight	$3,625.9	31	0.94
Allentown-Bethlehem-Easton, PA-NJ	Textiles	$3,606.5	32	1.44
Kansas City, MO-KS	Mixed Freight	$3,601.1	33	1.03
Albany-Schenectady-Troy, NY	Mixed Freight	$3,522.5	34	0.67
Dayton, OH	Mixed Freight	$3,442.5	35	0.71
Kansas City, MO-KS	Textiles	$3,322.4	36	0.34
Buffalo-Niagara Falls, NY	Metals	$3,100.6	37	1.12
Baltimore-Towson, MD	Mixed Freight	$3,059.1	38	0.85
Greensboro-High Point, NC	Furniture	$2,922.4	39	6.89
Atlanta-Sandy Springs-Marietta, GA	Metals	$2,858.3	40	0.69
Los Angeles-Long Beach-Santa Ana, CA	Furniture	$2,826.8	41	1.01
Cleveland-Elyria-Mentor, OH	Metals	$2,695.8	42	2.37
St. Louis, MO-IL	Energy Products	$2,688.3	43	0.43
Orlando-Kissimmee-Sanford, FL	Mixed Freight	$2,614.0	44	0.84
Charleston-North Charleston-Summerville, SC	Metals	$2,608.0	45	2.35
Des Moines-West Des Moines, IA	Mixed Freight	$2,605.2	46	0.89
Salt Lake City, UT	Mixed Freight	$2,531.9	47	0.88
El Paso, TX	Metals	$2,515.4	48	2.20
Allentown-Bethlehem-Easton, PA-NJ	Mixed Freight	$2,490.5	49	0.88
Fresno, CA	Mixed Freight	$2,421.5	50	0.79
Phoenix-Mesa-Glendale, AZ	Mixed Freight	$2,419.3	51	0.97
Springfield, MA	Mixed Freight	$2,387.1	52	0.73
Fresno, CA	Textiles	$2,368.4	53	0.17
Grand Rapids-Wyoming, MI	Furniture	$2,301.9	54	9.37
Lancaster, PA	Wood Products	$2,288.7	55	2.93
Indianapolis-Carmel, IN	Wood Products	$2,241.3	56	0.86
Dallas-Fort Worth-Arlington, TX	Furniture	$2,133.5	57	1.19
Tulsa, OK	Energy Products	$2,056.5	58	4.96
Memphis, TN-MS-AR	Agricultural Products	$2,037.3	59	0.66
Portland-Vancouver-Hillsboro, OR-WA	Wood Products	$2,031.5	60	0.89

Source: Brookings analysis of Economic Development Research Groupand Census data.

Washington, D.C.: Generating a Goods Trade Surplus in Only Garbage

As the nation's capital, metropolitan Washington contains a unique mix of public- and private-sector firms that add economic value through knowledge, innovation, and high levels of human capital.[76] In fact, service industries account for more than 95 percent of the metro area's total output, second only to Honolulu.[77] In addition to government, Washington is a hub for research and development, technology, and tourism as well as the nation's fourth-largest economy.[78] Goods trade helps fuel these service activities, connecting Washington to global value chains as a major goods consumer.

Metropolitan Washington takes in $85.8 billion more goods than it sends out. It must bring in not only enough food and energy to satisfy its large and growing population, but also enough electronics and machinery to equip firms such as Northrop Grumman, General Dynamics, and AES Corporation.[79]

With an extensive service base and a relatively smaller core of goods-producing industries, Washington serves as a key destination for freight. While it ranks 10th in total inflows ($127.6 billion) among the 100 largest metro areas, comparable to Miami and San Francisco, it ranks just 47th in total outflows ($41.8 billion), on par with Oxnard, CA, and Dayton, OH. Although Washington has almost $8.8 billion in outflows of electronics—supported by its concentration of information and communication technology companies—its inflows are $16.8 billion.[80] The same proves true for chemicals/plastics and machinery/tools, where it simply does not create enough excess production for widespread distribution elsewhere. Of all commodities, only waste produces a trade surplus ($0.5 billion).

Washington's reliance on external markets is clear. The only metro areas that come close to such lopsided proportions are Cape Coral, FL, Honolulu, and Las Vegas. Washington relies heavily on domestic agricultural products, machinery/tools, and goods typically sold in retail stores (categorized here as "mixed freight). It also imports many similar goods from international markets, including textiles, to support the daily rhythm of its households and firms.

In this way, Washington's service-based economy depends on global goods trade to operate, even though it primarily functions as a consumer rather than a producer. In stark contrast to industrial hubs like Houston and Portland, Washington does not have many surplus goods to distribute beyond its borders, except waste. However, that deficit should not diminish the metro area's importance in global value chains, as it adds value in ways beyond physical production through its many service activities.

Non-metropolitan Areas: Supplying and Moving America's Critical Commodities

As the nation's primary freight hubs, metropolitan areas depend on raw materials sourced and shipped from their hinterlands.[81] Non-metropolitan areas, stretching from the cornfields of Nebraska and oilfields of Texas to the silver mines of Nevada and stone quarries of Pennsylvania, grow the ingredients and extract the resources that serve as the backbone for global value chains.

Although non-metropolitan regions move $3.7 trillion of goods, they specialize in heavier goods. Energy and agricultural products compose nearly two-thirds of their commodities, followed by stones/ores (573 million tons), chemicals/plastics (334 million tons), and wood products (331 million tons). These goods, in many ways, are the building blocks for advanced metro economies.

Certain regions are very active in the energy and agricultural sectors. The non-metropolitan parts of Iowa and Illinois cultivate the most agricultural goods (235 million tons in total) through their large-scale farming operations, while Wyoming moves the most energy products (502 million tons), drawing from the rich coal deposits in the Powder River Basin. In fact, the amount of energy moved to and from Wyoming is so great that it helps to power one out of every five homes and businesses in the United States.[82]

This specialization in raw commodities means non-metropolitan regions transport goods with an average value ($680 per ton) less than half that of the 100 largest metro areas ($1,563 per ton). Although several areas transport goods worth considerably more—including areas of New Hampshire that move valuable electronics and precision instruments as part of the state's growing high-tech sector—others concentrate on moving bulk goods and natural resources found locally.[83]

Non-metropolitan regions, as such, tend to gravitate toward domestic trade. The goods from non-metropolitan regions in Colorado, Utah, and New Mexico, for instance, are almost all traded domestically as they mine the heavy stones/ores and energy products prevalent in the Mountain West.[84] Non-metropolitan regions of Washington and Oregon are among only a few areas with international shares higher than 10 percent, exporting many agricultural and wood products.

Through their various goods, non-metropolitan regions provide metro areas with the needed inputs to add value and generate output. They provide the food, energy, and raw supplies that enable metro areas to function in an increasingly competitive global trade network. Even as the U.S. economy focuses more on exporting high-value goods and services, non-metropolitan regions remain significant, allowing for greater metropolitan specialization and supporting U.S. global goods trade.

VI. Issues and Implications

Metropolitan trade is endemic in modern economies. Regions with concentrated assets depend on other areas for both production and consumption of the goods they trade. In the end, these intricate relationships enable modern global economies to grow. Although these relationships are still not well understood, the statistics in this report begin to explore new dimensions to goods trade and point to implications for metropolitan leaders. Those implications include the following:

Metro leaders can use these documented trade volumes and balances to better understand their economic starting point.

The trading patterns in metro areas reflect their specialization in goods and services production. This report enables metro leaders to better understand their distinctive strengths in what and where they trade, and how that trade relates to their regional peers.[85] Significantly, this research shows that advanced industries represent the kind of globally competitive products that can maximize internationally exported value. Just as important, the chief assets to build those industries are located within the country's largest metropolitan areas.

Advanced industries employ a highly skilled workforce and through intense research and development represent the core sites of technological innovation in the United States. They make the kind of products that simply did not exist a century ago, from lithium-ion batteries and high-end pharmaceuticals to satellite equipment. Advanced industries compose more than 11 percent of the overall economy, generate 45 percent of U.S. goods exports, and support more than 4 million high-skilled jobs, along with several million more ancillary jobs.[86] These industries cannot exist in just any location. They require a sensitive mix of labor, equipment, and investment to make their product designs a reality. This makes advanced economies like the United States—with a well-educated population, efficient and well-connected trade infrastructure, and deep financial markets—the ideal locations for these modern industries.[87]

This research shows that the 100 largest metro areas already trade a majority of the value of the commodities that advanced industries are most likely to manufacture: precision instruments (73 percent), electronics (71 percent), chemicals/plastics (63 percent), machinery/tools (61 percent), and transportation equipment (60 percent). The AI strengths in electronics and precision instruments in metro areas such as Austin, San Jose, and Boston are well known. This report also points to similar, albeit smaller, positive trading relationships in metro areas such as Nashville, Oxnard, Boise, and Poughkeepsie. These AI markets enjoy advantages of an educated workforce, venture capital funding, the presence of research universities, and critical transportation assets. These advantages also include the labor, physical, and financial assets needed to expand that manufacturing base even further.

Trading AI products requires more than just the physical creation of products. Manufacturing those products depends on related service occupations staffed with a well-educated workforce. Those tasks range from initial product designs to the financing of facility investments and to marketing and sales. Goods trade data do not capture this service side of value creation. The geography of these service impacts requires further investigation. Understanding how firms cluster across multiple industrial sectors—or do not cluster—will help lead to a better understanding of metropolitan supply chains, and the complete value derived from goods trade.

Not every metro area specializes in AI sectors. The positive trade balances in metro areas such as Omaha (agriculture), Tucson (stones/ores), Augusta, GA, (wood products), and Greensboro, NC (textiles) also reveal unique assets metro leaders should continue to maintain. Fortunately, each metro area does enjoy a trade surplus in at least one commodity, and usually more than one. Leaders in every metro area should know what their surplus goods sectors are and build on these distinctive strengths.

Metro leaders should integrate goods movement into their broader transportation and economic development programs, particularly with regard to exports, and draw on the innovative practices of other metro areas in doing so.

Portland and Minneapolis are among a handful of metro areas already advancing their own dynamic freight plans as a way to maximize economic development. These places have forged a new path, expanding freight's scope beyond individual transportation modes and establishing a policy framework based on freight's economic impacts. A new understanding of metro trade volumes and balances should augment these plans.

Portland's freight plan draws from the region's history as a northwestern freight hub and aims to strengthen its position in global value chains.[88] Portland assesses freight needs in light of its overarching economic priorities by identifying the infrastructure assets that facilitate this movement and prioritizing improvements based on traffic from nearby industries. Through this approach, Portland's leaders reinforce trade's fundamental link to the metropolitan economy and explore ways to spur additional output, job growth, and exports.[89] The newly formed Greater Portland Export Plan adds even more momentum by outlining strategies to leverage the region's trade specialization in high-end electronics by strengthening supply chain relationships abroad.[90]

Minneapolis pursued a similar freight strategy by focusing on the long-term efficiency and reliability of infrastructure to service its goods trade. The Twin Cities Metropolitan Area Freight Initiative emphasizes stronger partnerships with private-sector firms, including new institutional arrangements to promote better freight cooperation.[91] Other objectives include an evaluation of existing transportation

plans, a comparison of best practices among peer cities, and the development of performance measures for freight projects. Other economic plans, including the Minneapolis-Saint Paul Export Plan developed in 2012, draw guidance from this strategy and aim to extend the metro's reach to global markets.[92]

National and state plans should build off these metropolitan efforts to capture the importance of freight in economic development. Declining infrastructure means that a highway bottleneck, congested railway interchange, or deteriorating inland waterway halfway across the country can easily impact local economies. This creates an incentive for all metro areas to not only understand their network of trading partners, but also to collaborate or support freight investments beyond their borders. It also shows why national-level corridor investments—like the Heartland rail corridor and Mississippi River investments—have the power to benefit all markets.

Ultimately, all metro leaders—and national policymakers—must better understand the quality and purpose of the nation's freight networks. Forthcoming research in this series will focus on specific freight modes (e.g., roads, rails, ports, and pipes).

Metro area leaders should build networks of firms, institutions, and individuals from existing and potential trading partners.

While specific firms and logistics companies may understand their domestic networks and specific global connections, metro leaders must also recognize the new orientation of global production and trade.

Entire production processes now rarely take place in one single region, or even within one country. Commodity chains now extend across the world, relying on particular countries and their metropolitan regions to provide commodities at the highest quality for the lowest price. A firm may design a product in an American office building, order products from advanced manufacturing plants elsewhere in the United States and Europe, ship the products to Asia for final assembly, and then distribute the final consumer product to markets all around the world.

The new information in this report demonstrates the global orientation of each metro area. It shows that large metros like New York, Houston, and Los Angeles exchange massive amounts of goods with the rest of the world. It also shows that other metros with a relatively large share of their trade that is international—like Bridgeport (precision instruments), Palm Bay (electronics), and Wichita (transportation equipment)—also have a significant global orientation.

Many of the metro areas with the strongest concentrations of trade in the domestic marketplaces hould take steps to become more globally fluent. Reorienting their goods trade is neither quick nor easy and large macroeconomic forces in the global economy are beyond the control of most metro areas.[93] But other metro areas, such as Syracuse, where 91 percent of goods trade is domestic, have positive overall trading balances in commodities like metals, machinery/tools, and precision instruments. That region is engaged in a deliberate effort to double exports through a range of strategies that support existing exporters while cultivating new ones.[94]

In many ways, this report only scratches the surface of what metropolitan trade networks can uncover. Further research will provide details on the precise trading relationships between metro areas both within the United States and around the world.

VII. Conclusion

Metropolitan areas are the primary drivers of global goods trade, moving an enormous amount of freight to spur economic growth. With access to markets far beyond their borders, they exchange a variety of goods to function locally and to compete globally in trade networks that now touch every corner of the world. The 100 largest metropolitan areas moved 7.8 billion tons of freight worth more than $12.2 trillion in 2010 alone, surpassing all other regions nationally and signaling the importance of goods trade to the American economy.

By focusing on domestic and international freight movement, this report is the first to examine goods trade at a metropolitan scale. Offering a new way to visualize freight movement, it highlights the crucial role played by metropolitan goods trade within the United States and abroad, in terms of

both the volume and balance of this trade. In doing so, it helps reveal the tight interrelationship among metro economies within larger global value chains and addresses a shortcoming of national-level trade statistics.

We hope this work engages a group of innovative thinkers, practitioners, and policymakers. Armed with this new knowledge, metropolitan leaders can better understand their economic starting point in goods trade. They can gain a clearer picture of how their local economies move different types of goods, which can help guide investments in industries essential to these movements. At the same time, they can begin to see how their economies connect to other markets in different ways and what these relationships hold for future development strategies. Forging stronger networks to support this trade, moreover, can benefit all metropolitan areas as they address their collective needs.

Appendix A. Study Design

Goods Trade Database

This report uses a unique database measuring goods traded among: U.S. metropolitan areas, non-metropolitan regions, and international geographies. We used the data foundation and design scheme of the publicly available Freight Analysis Framework (FAF), Version 3.2. The U.S. Federal Highway Administration (FHWA) constructed the database with the help of the Oak Ridge National Laboratory (ORNL).[95] The database provides a comprehensive view of freight movement to, from, and within the United States. Based on calendar year 2007, version 3.2 has been provisionally updated to estimate 2010 total freight volumes, or flows, by annual tonnage, value, and ton-mileage.

FAF estimates and assigns these flows through a matrix based on the shipment origin (O), shipment destination (D), commodity being transported (C), and mode used (M). To build this matrix and model freight movement, FAF draws from multiple data sources, but is principally derived from the Commodity Flow Survey (CFS), which is conducted every five years through a partnership between the U.S. Census Bureau and the Bureau of Transportation Statistics (BTS) as part of the Economic Census.[96] The CFS is a shipper-based survey that tracks the number of tons and dollar value of goods transported annually across all modes between different regions of the United States. However, because the CFS excludes imports and collects limited data for several freight-related industries, FAF uses a multi-step approach and additional data sources to estimate these "out-of-scope" flows.

In total, the FAF matrix covers 131 geographic regions, 43 commodities, and seven transportation modes. Geographically, FAF's O-D movements span 123 domestic regions and eight world regions, including 74 state-specific U.S. metropolitan areas, 33 state remainders, and 16 whole states. Metropolitan areas in FAF do not cross state lines, meaning metros are frequently divided into different parts depending on the states located in their respective metropolitan statistical area. Kansas City, for instance, is divided between two states (Missouri and Kansas). In addition, FAF does not follow a single metropolitan geographic definition, and instead uses both Combined Statistical Area (CSA) and Core Based Statistical Area (CBSA) definitions. For international flows, Canada, Mexico, and six groups of multiple other countries are included and classified in the same way as statistical regions by the United Nations.[97] Despite FAF's extensive spatial scope, it often lacks granularity for specific metro areas and for even most country-level origins and destinations.

FAF reports commodities at the Standard Classification of Transported Goods (SCTG) system's two-digit level. Collectively, there are 43, two-digit SCTG commodity codes, ranging from live animals and fish (SCTG-01) to logs (SCTG-25) and mixed freight (SCTG-43). FAF relies on a variety of data sources to estimate these commodity flows because many goods, including agricultural and petroleum products, are concentrated in industries that fall outside the scope of the CFS.

By partnering with Economic Development Research Group (EDR), we were able to modify FAF to create a new database that identifies commodity flows with greater domestic and international precision. Trade data from the World Institute for Strategic Economic Research (WISER), in addition to industry data from IMPLAN and Moody's Analytics, were particularly important to help model freight movement in terms of local economic activity. While carrying out this work, we have also addressed several gaps and discrepancies inherent in FAF.

With an interest in showing domestic and international freight flows in, out, and among all of the country's metropolitan areas, we worked with EDR to estimate freight movement across combined statistical areas (CBSAs). Because FAF zones and CBSAs have overlapping spatial coverage at the county level, we first allocated FAF zone flows down to individual counties and then aggregated up to larger CBSAs. To accomplish this task, we used appropriate production, consumption, and port flow data when allocating totals—in both dollars and tonnage—to specific domestic origins and destinations.

Domestically, the estimation process varied slightly depending on the exact geography, mode, and type of flow in question. For example, we assigned flows between two distinct metropolitan areas on the basis of the magnitude of production and consumption in each area, while we used an additional gravity constraint when estimating flows that involved large FAF zones, such as state remainders, to match supply and demand over longer distances. A gravity constraint is a way to use distance, alongside economic data, when determining trade flows between places.

In all domestic regions, the process essentially followed three steps: (1) allocate the commodity supply on the basis of the county share of industries producing this commodity; (2) allocate the commodity demand on the basis of the county share of industries consuming this commodity; and (3) balance the commodity production and attraction on the basis of modal availability. We then aggregated these county commodity flows in turn to their respective CBSAs, while approximating the original FAF aggregate totals for the particular commodity. We classified remaining flows not included in the CBSAs under state remainders.

Internationally, the estimation process relied more extensively on a gravity constraint to allocate export and import flows, primarily because of commodity sourcing issues in FAF. Because FAF defines international movement in two ways—separating the domestic and international legs—there was a statistical concern regarding port-related metros over-assigned local production and consumption trade flows. Miami, for instance, not only served as an enormous port for moving exports out of the country, but FAF also recorded it as one of the largest producers (or origins) for these exports. Anchorage, likewise, served as a primary port of entry for imports, but it designated as one of the largest consumers (or final destinations) for these imports. Our new database, in contrast, used WISER trade data and an additional gravity constraint to link the origin for exports and destination for imports more directly in terms of patterns of economic production and consumption. The results are a relative match for past Metropolitan Policy Program export research, sharing a 0.91 correlation with ExportNation's 2010 goods data.[98] However, because this report and ExportNation use different statistical bases, and only ExportNation includes service exports, the actual numbers will not match between the two datasets.

Among commodities that fall outside the scope of the CFS, crude petroleum (SCTG 16), in particular, required additional attention. Limited by the sample size for this commodity—along with numerous industry records suppressed for confidentiality—FAF relies on a variety of sources to estimate petroleum flows by value and weight at the county level. To address such gaps, our database allocates these missing flows to counties with non-suppressed refinery data.

In summary, our new database uses the same database design as FAF but adds geographic granularity and increased data certainty. It still includes all 43 two-digit SCTG commodities and seven transportation modes.[99] Geographically, the database now includes 361 metropolitan areas, 48 state remainders, and 40 international geographies.[100] Table A1 lists the specific countries, country groups, and continental remainders.

Table A1. International Geographies Included in Brookings Goods Trade Database

Foreign Geography	Geography Type
Argentina	Country
Brazil	Country
Canada	Country
Chile	Country
China	Country
Colombia	Country
France	Country
Germany	Country
India	Country
Japan	Country
Republic of Korea	Country
Mexico	Country
Netherlands	Country
Singapore	Country
South Africa	Country
Spain	Country
Turkey	Country
United Kingdom	Country
Western Africa	Country Group
Eastern Africa	Country Group
Northern Africa	Country Group
Middle Africa	Country Group
Caribbean	Country Group
Australia and New Zealand	Country Group
Melanesia	Country Group
Micronesia	Country Group
Polynesia	Country Group
Central Asia	Country Group
Eastern Europe	Country Group
Remainder of South America	Rest Of Group
Remainder of Central America	Rest Of Group
Remainder of Southern Africa	Rest Of Group
Remainder of North America	Rest Of Group
Remainder of Eastern Asia	Rest Of Group
Remainder of Southern Asia	Rest Of Group
Remainder of South-Eastern Asia	Rest Of Group
Remainder of Southern Europe	Rest Of Group
Remainder of Western Asia	Rest Of Group
Remainder of Northern Europe	Rest Of Group
Remainder of Western Europe	Rest Of Group

Source: Brookings Institution and Economic Development Research Group

Finally, the database and report's analytics are only an estimation of expected goods trade and freight activity. While the CFS and FAF are based on an extensive survey of freight shippers, as are EDR's use of WISER's international shipping information, even the best surveys may over- or under-state certain trade levels. Likewise, while EDR uses well-regarded gravity constraints and production and consumption data, these data modifiers can miss certain trading relationships. For example, the data modifiers have no method to purposely account for under-reported intrafirm trading relationships. These pitfalls are no different from other survey-based statistical analyses, but they are worth considering if certain trade levels or trading relationships appear off-base.

Time Periods Covered

Although FAF provides estimates of projected flows from 2007through 2040, we only include 2010 provisional data in our database. Given the constantly changing nature of freight movement and other economic developments, it can be difficult to gauge these sudden—and sometimes lasting—fluctuations. Limitations and inconsistencies in existing freight data also make it challenging to track potential changes over time nationally, internationally, and between metro areas, most notably since FAF is the only subnational freight database and it precludes longitudinal comparisons. At the time of production, 2010 FAF estimates were the most current and comprehensive data available, which we adjusted to more precisely track commodity flows at the metropolitan scale. Future updates to our database would prove useful in monitoring freight movement changes over time, especially as the economy continues to emerge from the Great Recession.

Intermetropolitan Flows versus Intrametropolitan Flows

This particular report focuses on goods trade *between* metropolitan areas, meaning the geographic origin and destination are always different places. However, there is also a significant share of goods trade that occurs within metropolitan areas. An assessment of such intrametropolitan goods trade would require a closer examination of several alternate trading dynamics and particular freight concerns.

Value, Tonnage, and Value per Ton

This report uses two primary units of measure to describe intermetropolitan freight movement: value (in millions of dollars) and tonnage (in thousands of tons). In aggregate, both measures reveal how much traded goods are worth and weigh across different origins and destinations.

Value per ton offers another helpful way to interpret overall and commodity-specific movements. By dividing the total freight value by the total freight tonnage in a particular metro, we are able to examine how the average value of goods varies across geographies. Depending on a metro area's commodity or industry specialization, for instance, the average value of its freight could differ markedly even when compared with the average value observed in neighboring metro areas. The relative value of its international goods, likewise, could range widely depending on the foreign origin and destination. Lastly, certain commodities, such as precision instruments, are consistently more valuable than other commodities, regardless of their origin or destination.

Trade Balances

Measuring the balance of goods trade—subtracting a metro area's total inflows from its total outflows—represents a key analytical approach beyond simply examining trade volumes. In particular, this approach allows us to identify metro areas as net consumers or producers of goods on the basis of their trade patterns. It also helps overcome many of the "pass-through" issues in FAF, namely by distinguishing those commodities that receive light value-add activities as they travel through a metro area en-route to somewhere else, versus those goods that are produced or consumed locally.

Trade balances are considered to be a deficit if inflows are larger than outflows and a surplus if outflows are larger than inflows. This report includes trade balances across both value and weight measures, and similarly divides trade balances across domestic, international, and total trade geography. Finally, within those balances, metro areas can have a surplus or deficit in individual commodities.

Industry Connections and Commodity Groups

Goods trade volume and balances offer a useful way to gauge the profile of a metropolitan economy. By viewing commodities in light of the industries that "make" and "use" them, the following method allows us to assess this underlying relationship.

While partnering with EDR, we reviewed a series of input-output (I-O) tables, similar to those developed by the U.S. Bureau of Economic Analysis (BEA).[101] As defined by BEA, output (or make) tables show the production of commodities by industry, while input (or use/recipe) tables show the uses of commodities by intermediate and final users. Put simply, output tables illustrate the types of goods that different industries produce (in dollars), while input tables show the variety of goods used by these industries (in dollars) to produce their final goods or services.[102] Each industry, furthermore,

features a unique "make share" and "use share" for specific commodities. Make shares depict the amount of a commodity that is produced per dollar of total output, and use shares depict the amount of a commodity required to produce every dollar of total output. In the furniture manufacturing industry, for instance, furniture products have a make share slightly less than 1, meaning that for every dollar of the industry's output, this commodity essentially represents the only final good produced. The same industry, though, commonly requires wood products to create this furniture, represented by a use share of less than 0.3. In other words, the industry uses 30 cents worth of wood products to create every dollar of output.

For many industries, there is a direct 1:1 relationship for particular commodities based on their make shares. Industries that specialize in automobile manufacturing, logging, or tobacco farming are among those that typically produce only one type of commodity. In contrast, there is often a one-to-many relationship for industries and commodities based on their use share, highlighting how industries frequently use different input commodities to create their output goods. In most cases, SCTG commodities such as base metals and machinery may account for only a fraction of a cent for every dollar of production. These commodities, in turn, are used as inputs in hundreds of industries, ranging from steel manufacturers to electronics manufacturers.

With this background in mind, we analyzed the make-use shares for the 43 2-digit SCTG commodities across EDR's input-output matrix based on the North American Industry Classification System (NAICS). To manage the many industries that made products falling under multiple commodity codes, we created our own commodity classification system of 15 new commodity groups, shown in Table A2. This created a cleaner crosswalk between NAICS economic output data and SCTG commodity codes.

By doing so, we were able to clearly relate 107 "production-oriented" and 206 "service-oriented" four-digit NAICS industries to one of the 15 commodity groups. In short, the 107 production-oriented industries all had a make share for at least one commodity, while the remaining 206 service-oriented industries did not have a make share for any commodity. As a result, we classified production-oriented industries under 15 commodity groups, and created a 16th commodity group—for non-commodities—to classify service-oriented industries. While these service-oriented industries did not produce any physical goods, they did play an important role in using the 15 other commodities to provide their services, as based on their use shares.

After linking commodities with their respective NAICS industries in this way, we were able to gauge how much production was linked to specific inputs and outputs across different metro areas. For each metro area, we downloaded 2010 GDP data from Moody's Analytics that applied to the four-digit industries included in our crosswalk. We then calculated the relative amount of production associated with each commodity on the basis of the industries linked to these goods, first in terms of output and later in terms of input.

There are two critical limitations to I-O tables and commodity crosswalks for this report's analytical approach. First, I-O tables do not capture household consumption patterns. Although I-O tables do show how much food or energy an industry may consume, they do not reference how much households may consume of similar products. In this sense, an I-O table cannot fully predict the aggregate level of commodity consumption taking place in a particular geography. Second, this report relied on a single I-O table for the entire country, and therefore does not capture variable industrial patterns by metropolitan area. Firms within the same industry will vary in the value of their inputs and outputs, meaning each metro should technically follow a unique I-O table based on their unique collection of firms and industry quality. This omission from our commodity-economic comparison will affect the results to an unknown degree and is an important area to improve in future research.

Table A2. Commodity Groups Included in Goods Trade Database

Commodity Name	Description	Relevant SCTG Codes
Agricultural Products	Includes various animal products, baked goods, and agricultural crops, ranging from fruits and vegetables to nuts and cereal grains. Also includes processed foods, tobacco products, and alcoholic beverages.	SCTG 01-09
Stones/Ores	Includes stone-related goods like gravel, a variety of non-metallic minerals like salt, and metal ores like iron.	SCTG 10-14
Energy Products	Includes coal and its related byproducts, oil products like crude petroleum and gasoline, and other liquefied fuels and oils.	SCTG 15-19
Chemicals/Plastics	Includes plastics, fertilizers, rubber, and a host of other organic and inorganic chemicals. Also includes pharmaceuticals and chemical mixtures for medical use.	SCTG 20-24
Wood Products	Includes logs, lumber, and other wood products, such as particle board. Also includes numerous paper products in the form of pulp, sheets, or printed materials.	SCTG 25-29
Textiles	Includes fabrics, yarns, and similar textiles used for clothing, carpets, and household furnishings. Also includes leather used for footwear, luggage, and other apparel.	SCTG 30
Metals	Includes base metals, such as steel, copper, and aluminum, in the form of bars, rods, and wire. Also includes ceramics, glass, and other cement mixtures.	SCTG 31-32
Machinery/Tools	Includes machines, parts, and gears used in a variety of mechanical equipment, such as engines, fans, and refrigerators. Also includes metal articles and tools, plus miscellaneous manufactured products like toys, clocks, and musical instruments.	SCTG 33-34, 40
Electronics	Includes a range of electrical components and equipment, from circuits and semiconductors to televisions and computers. Also includes communications equipment and transmission apparatus.	SCTG 35
Transportation Equipment	Includes parts and vehicles for automobiles, railroads, aircraft, ships, and other transportation equipment.	SCTG 36-37
Precision Instruments	Includes medical, scientific, and optical instruments, among other advanced surgical and navigational tools.	SCTG 38
Furniture	Includes household and office furniture, mattresses, medical furniture, and lighting fixtures.	SCTG 39
Waste/Scrap	Includes scrap and waste from wood, paper, glass, and metals.	SCTG 41
Mixed Freight	Includes miscellaneous food and supplies for offices and retail establishments, such as convenience stores and restaurants.	SCTG 43
Unknown	Includes goods not classified under any other commodity group.	SCTG 99

Source: Brookings Institution and Economic Development Research Group

Endnotes

1. Jane Jacobs, *The Death and Life of Great American Cities* (Vintage Books, 1992), p. 340.

2. Bruce Katz and Jennifer Bradley, *The Metropolitan Revolution: How Cities and Metros Are Fixing Our Broken Politics and Fragile Economy* (Washington: Brookings Institution Press, 2013), chapter 7.

3. Brookings analysis of World Trade Organization data.

4. Emilia Istrate and Carey Anne Nadeau, "Global MetroMonitor 2012: Slowdown, Recovery, and Interdependence" (Washington: Brookings Institution, 2012).

5. See also the accompanying primer for a deeper discussion on trade and economic growth: Adie Tomer, Joseph Kane, and Robert Puentes, "Metro Freight: The Global Goods Trade That Moves Metro Economies" (Washington: Brookings Institution, 2013).

6. Alan Berube and Joseph Parilla, "MetroTrade: Cities Return to their Roots in the Global Economy" (Washington: Brookings Institution, 2012).

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9. Jean-Paul Rodrigue, *The Geography of Transport Systems* (Routledge, 2009).

10. Organisation for Economic Cooperation, "Interconnected Economies: Benefitting from Global Value Chains" (2013).

11. Trade balances here refer to the balances of goods trade only, and not the balance of services.

12. Brock R. Williams and J. Michael Donnelly, "U.S. International Trade: Trends and Forecasts" (Washington: Congressional Research Service, 2012).

13. Emilia Istrate, Jonathan Rothwell, and Bruce Katz, "Export Nation: How U.S. Metros Lead National Export Growth and Boost Competitiveness" (Washington: Brookings Institution, 2010).

14. J.D. Gould, "The Trade Crisis of the Early 1620s and English Economic Thought," *Journal of Economic History* 15 (2) (1955): 121-133.

15. For a thorough discussion of post-Mercantilist trade balances, see Adam Smith, *An Inquiry into the Nature and Causes of the Wealth of Nations* (1776), book 4, chapter 3.

16. Berube and Parilla, "MetroTrade."

17. National balances of trade remain an important measure of macroeconomic health, helping gauge a nation's comparative advantage and to determine whether it is using its factors of production in an efficient manner. At the same time, nations can use their trade balance—and trade volumes more generally—to guide decisions about the allocation of scarce resources and to spur investment in industries critical to sustaining long-term economic growth.

18. For U.S. trade balances dating back to the 18th century, see Robert Lipsey, "U.S. Foreign Trade and the Balance of Payments, 1800-1913" (Cambridge, MA: National Bureau of Economic Research, 1994). To see historic balances from 1900 and the transition to greater manufacturing exports, see United Nations Statistics Division, "International Trade Statistics, 1900-1960" (1962).

19. U.S. Census Bureau, Historical Series, U.S. International Trade In Goods and Services.

20. "Trade Balance," *The Economist*, April 14, 2013.

21. Jean-Paul Rodrigue, *The Geography of Transport Systems*.

22. Alan Berube, "MetroNation: How U.S. Metropolitan Areas Fuel American Prosperity" (Washington: Brookings Institution, 2007).

23. Bruce Katz and Mark Muro, "The New 'Cluster Moment': How Regional Innovation Clusters Can Foster the Next Economy" (Washington: Brookings Institution, 2010).

24. Brad McDearman, Greg Clark, and Joseph Parilla, "The 10 Traits of Globally Fluent Metro Areas" (Washington: Brookings Institution, 2013).

25. The transportation modes are Air (Includes Truck-Air); Multiple Modes and Mail; Pipeline; Rail; Truck; Water; and Other and Unknown. There is a separate category for international movements with no domestic transportation mode.

26. However, this should not undersell the importance of

trans-shipment points in those relationships. Ports such as Laredo and Anchorage and logistical hubs such as Louisville and Memphis all play an enormous role in goods trade domestically and abroad. Further analyses will address their role.

27. This report does not address freight flows *within* metropolitan areas. For a thorough analysis of intrametropolitan freight issues, also known as urban freight, see for example, Peter Plumeau and others, "Guidebook for Understanding Urban Goods Movement" (Washington: Transportation Research Board's National Cooperative Freight Research Program of the Transportation, 2012); Genevieve Giuliano and others, "Synthesis of Freight Research in Urban Transportation Planning" (Washington: Transportation Research Board's National Cooperative Freight Research Program of the Transportation, 2013).

28. A metropolitan area is a collection of adjacent counties that include at least one urban core of 50,000 people and share commuting ties. For the complete current definition of metropolitan areas, see Office of Management and Budget, "OMB Bulletin No. 13-01" (February 28, 2013). This report uses metropolitan borders defined from the 2000 decennial census.

29. Appendix A includes a complete list of metropolitan areas, based on 2000 definitions, not included in this database. These metropolitan areas are part of their states' nonmetropolitan remainders.

30. While advanced industries are likely to produce goods within these commodity groups, each commodity group captures goods related to a broader range of industries. For example, Chemicals/Plastics includes pharmaceutical products—an AI-related product—but also lower-value products such as inorganic chemicals and fertilizers.

31. This is an especially important analytical perspective in the largest countries, which can have a relatively diverse economy or cover a geographically extensive area. In essence, a lack of domestic trade measures makes it impossible to judge whether a country relies more on domestic or international trade markets, and how these markets vary across specific regions and commodity types.

32. For national totals, domestic volumes combine all intermetropolitan outflows and inflows, each of which amounts to $8.6 trillion and 7.7 billion tons. As such, U.S. domestic volumes total $17.2 trillion and 15.5 billion tons. These domestic volumes, in turn, may differ from the domestic values and weights reported for the country as a whole by the Bureau of Transportation Statistics (BTS) and other government agencies. These figures only reflect goods traded in and out of a particular region, both internationally and domestically.

33. Using international data on tradable services as a proxy, the 100 largest metropolitan areas generate 75 percent of national service exports. See: Emilia Istrate and Nicholas Marchio, "Export Nation 2012: How U.S. Metropolitan Areas Are Driving National Growth" (Washington: Brookings Institution, 2012).

34. When correlating metropolitan GDP against the metropolitan area's total freight volume by value, the correlation coefficient is 0.87. This is considered a very strong relationship.

35. The correlation coefficient between total goods trade flows—both inflows and outflows—and total goods-related metropolitan output—counting both production and consumption—is 0.90. This is considered a very strong relationship.

36. This metric uses an input-output table and commodity-to-industry crosswalk to calculate the share of a metropolitan economy dedicated to goods production and consumption. For more information, see Appendix A.

37. Brookings analysis of Moody's Analytics data.

38. Greater Houston Partnership, "Houston Facts: 2013 Edition" (2013).

39. Jesse Thompson, "Booming Shale Gas Production Drives Texas Petrochemical Surge" (Dallas: Federal Reserve Bank of Dallas, 2012).

40. Molly Ryan, "Oil and Gas Ventures Flood Houston Ship Channel with Wave of Business Growth," Houston Business Journal, February 1, 2013.

41. Simone Sebastian, "Houston Rides its Energy to No. 1 Export Spot," *Houston Chronicle*, July 13, 2013.

42. Within the chemicals/plastics commodity group, the 100 largest metro areas' share jumps to 69 percent for pharmaceuticals, which are worth over $46,000 per ton.

43. San Diego Workforce Partnership and San Diego Regional Economic Development Corporation, "The Economic Impact of Qualcomm: Driving San Diego's Technology Growth" ((2013).

44. See the metropolitan economy profiles in Howard Wial, "Interactive: Locating American Manufacturing," (Washington: Brookings Institution, 2011).

45. Alec Friedhoff and Siddharth Kulkarni, "Metro Monitor - September 2013" (Washington: Brookings Institution, 2013).

46. Brookings analysis of Moody's Analytics data. Tech industries refer to those industries that specialize in producing electronics and precision instruments.

47. Ross DeVol and others, "North America's High-Tech Economy: The Geography of Knowledge-Based Geographies" (Santa Monica: Milken Institute, 2009).

48. All three metropolitan areas—San Jose, Phoenix, and Austin—maintain location quotients above 2 in electronics production, making these metro areas heavily concentrated in the industry relative to national averages.

49. Mark Muro, "Advancing Advanced Manufacturing Region by Region," The Avenue blog, 2012, available at **www.brookings.edu/blogs/the-avenue/posts/2012/02/27-manufacturing-muro**.

50. Timothy Sturgeon, "What Really Goes On in Silicon Valley? Spatial Clustering and Dispersal in Modular Production Networks," *Journal of Economic Geography*, 3 (2003): 199-225.

51. McDearman, Clark, and Parilla, "10 Traits."

52. Brookings analysis of World Trade Organization data.

53. Brad McDearman, Ryan Donahue, and Nick Marchio, "Export Nation 2013" (Washington: Brookings Institution, 2013).

54. Brookings analysis of World Trade Organization data.

55. Trade statistics—including exports, imports, and the balance of trade, among other baseline measures—can vary depending on the specific data source in question. The World Trade Organization (WTO), for instance, focuses on world merchandise trade in terms of particular products, regions, and trading partners, drawing from a variety of sources, such as Eurostat and IMF International Financial Statistics. The U.S. Census Bureau reports goods trade data on the basis of documents collected by the U.S. Customs and Border Protection and adjusts these numbers to a balance of payments basis in coordination with the Bureau of Economic Analysis. Given the enormous scope of goods and services exchanged internationally, individual trade reports can range widely in their scope, coverage, and accuracy.

56. Although the total exported goods differ from statistics included in Brookings' "ExportNation" publications—owing to the same baseline differences in the prior endnote—the relative metropolitan values do correlate strongly to one another (0.91), confirming both methodologies report similar results.

57. Chemicals/plastics, the other AI category, is worth less on average and, owing to a mix of high weights and international pharmaceutical regulations, traded more within the domestic market.

58. Brookings analysis of Moody's Analytics data.

59. Austin generates the ninth most patents per capita of any U.S. metropolitan area. Jonathan Rothwell and others, "Patenting Prosperity: Invention and Economic Performance in the United States and its Metropolitan Areas" (Washington: Brookings Institution, 2013).

60. Source: Brookings analysis of World Trade Organization data.

61. National-level trade balances help decision makers determine macroeconomic and national fiscal policies. They are a major barometer for currency exchange rates, which have a dramatic effect on the direction of trade between countries—for example, a cheaper dollar relative to other currencies makes American exports more affordable. By most accounts, the years-long debate between the United States and China over the renminbi's exchange rate is a trade concern over all others. National trade balances also inform elements of negotiated trade relationships between countries, whether it is the establishment of a free trade agreement, consideration of higher tariffs, or the creation or removal of other trade barriers. For these two considerations and others, national-level actors need national-level trade balances. For more information on how exchange rates affect trade balances, see: Martin Baily, "Restoring Economic Growth" (Washington: Brookings Institution, 2012).

62. Paul Krugman, "Increasing Returns and Economic Geography, "*Journal of Political Economy* 99 (3) (1991): 483-499.

63. Chicago Metropolitan Agency for Planning, "The Freight-Manufacturing Nexus: Metropolitan Chicago's Built-In Advantage" (2013).

64. Howard Wial, "Locating Chicago Manufacturing: The Geography of Production in Metropolitan Chicago" (Chicago: Center of Urban Economic Development, 2013).

65. World Business Chicago, "Chicago's Business Climate" (2012).

66. McDearman, Clark, and Parilla, "10 Traits."

67. City of Chicago, "Energy Efficiency and Renewable Energy" (web page), available at **www.cityofchicago.org/city/en/progs/env/energy_efficiencyandrenewables.html** [accessed August 2013].

68. City of Chicago, "Mayor Rahm Emanuel Announces Export Strategy to Double Chicago Exports Over the Next Five Years." Press release (Chicago: Mayor's Office, 2012), available at: **www.cityofchicago.org/city/en/depts/mayor/press_room/press_releases/2012/april_2012/mayor_rahm_emanuelannouncesexportstrategytodoublechicagoexportso.html** [accessed August 2013].

69. For more information, see resources from the Chicago Manufacturing Renaissance Council, available at **www.chicagomanufacturing.org/**

70. Owing to the nondescript nature of commodity group "unknown," this section excludes that group from individualized calculations.

71. For more information about recent developments in waste/scrap trade, in particular with China, see Brad Plumer, "China doesn't even want to buy our garbage anymore," *Washington Post*, May 9, 2013.

72. Mixed freight also includes miscellaneous products often identified broadly by shippers rather than under a specific product category. Mixed freight totals vary depending on the way certain goods are shipped and classified as part of the larger transportation industry.

73. In the data used for this report, mixed freight is classified separately for domestic flows, but it is included within other commodity groups for international flows. Overall volumes and balances for this commodity, in turn, are based on domestic flows only.

74. Carey Durkin Treado, "Pittsburgh's Evolving steel Legacy and the Steel Technology Cluster," *Cambridge Journal of Regions* 3 (2010): 105-120.

75. In both 2010 and 2012, the 100 largest metropolitan areas generated over 75 percent of the country's service exports. McDearman, Donahue, and Marchio, "Export Nation 2013."

76. Office of the Deputy Mayor for Planning and Economic Development, "The Five Year Economic Development Strategy For the District of Columbia" (2012).

77. Brookings analysis of Moody's Analytics data.

78. Ibid.

79. Washington, DC, Economic Partnership, "DC Development Report: 2012/2013 Edition" (December 11, 2012).

80. Greater Washington Initiative, "Greater Washington 2010 Regional Report."

81. Theo Notteboom and Jean-Paul Rodrigue, "Re-Assessing Port-Hinterland Relationships in the Context of Global Commodity Chains." In J. Wang and others, eds., *Inserting Port-Cities in Global Supply Chains* (London: Ashgate, 2007).

82. U.S. Bureau of Land Management, "Powder River Basin," available at: **www.blm.gov/wy/st/en/programs/energy/Coal_Resources/PRB_Coal.html** [accessed September 2013].

83. Dennis Delay and Steve Norton, "Smart Manufacturing and High Technology: New Hampshire's Leading Economic Sector" (Concord: New Hampshire Center for Public Policy Studies, 2011).

84. Mark Kirschbaum and Laura Biewick, "A Geologic Assessment of Coal in the Colorado Plateau: Arizona, New Mexico, and Utah" (Washington: U.S. Geological Survey), available at: **http://pubs.usgs.gov/pp/p1625b/** [accessed September 2013].

85. In particular, these measures offer a new method to judge actual goods trade volumes against more traditional location quotient (LQ) measures. As global value chains shift the sites of physical production and idea creation, LQs may no longer easily predict which metro areas will generate higher goods outflows.

86. Devashree Saha and Mark Muro, "Cut to Invest: Create a Nationwide Network of Advanced Industries Innovation Hubs" (Washington: Brookings institution, 2013).

87. Organisation for Economic Cooperation and Development, "Interconnected Economies."

88. City of Portland, Office of Transportation, "City of Portland Freight Master Plan" (2006).

89. Brookings-Rockefeller Project on State and Metropolitan Innovation, "Greater Portland Export Plan" (Washington: Brookings Institution, 2012).

90. Istrate and Marchio, "Export Nation 2012"; Brookings-Rockefeller Project on State and Metropolitan Innovation, "Greater Portland Export Plan."

91. Minnesota Department of Transportation, "Twin Cities Metropolitan Area Regional Freight Initiative" (2011).

92. Brookings-Rockefeller Project on State and Metropolitan Innovation, "Minneapolis-Saint Paul Export Plan" (Washington: Brookings Institution, 2012).

93. McDearman, Clark, and Parilla, "10 Traits."

94. Brookings-Rockefeller Project on State and Metropolitan Innovation, "Syracuse/Center State New York Export Plan" (Washington: Brookings Institution, 2012).

95. The complete FAF3 documentation is available at: **http://faf.ornl.gov/fafweb/Data/FAF3ODCMOverview.pdf**.

96. To learn more about the CFS, see the online summary at **www.census.gov/econ/cfs/**.

97. The United Nations country-level codes and continental groupings are available at: **http://unstats.un.org/unsd/methods/m49/m49regin.htm**.

98. This correlation compares the 361 metropolitan areas shared between the two datasets. The complete ExportNation dataset and research series is available at **www.brookings.edu/about/projects/state-metro-innovation/mei**.

99. Note that EDR's estimation process caused two SCTG commodities—Mixed Freight (SCTG 43) and Commodity Unknown (SCTG 99)—to be separated individually in domestic trade but not in international trade. However, they are still included in the international totals, collapsed with the other commodity groups.

100. Due to statistical limitations, the following five metropolitan areas were not included in the database: Cape Girardeau-Jackson, MO-IL; Lake Havasu City-Kingman, AZ; Manhattan, KS; Mankato-North Mankato, MN; and Palm Coast, FL. All five were upgraded from micropolitan statistical areas to metropolitan statistical areas in the 2000s. Their trading relationships are added into the appropriate 'Remainder of State' totals.

101. To see the full methodology of BEA tables, see: **www.bea.gov/papers/pdf/IOmanual_092906.pdf**.

102. Note that goods can be simply consumed as well.

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- Provide metropolitan area leaders with proven, actionable ideas for how to expand the global reach of their economies, building on best practices and policy innovations from across the nation and around the world.
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