# Export Nation:
## How U.S. Metros Lead National Export Growth and Boost Competitiveness

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*"To reset its economic trajectory, the United States needs to connect the macroeconomic goal of increasing exports with the metropolitan reality of export production."*

### Findings

An analysis of the location of production of U.S. exports, particularly in the nation's 100 largest metro areas in 2008, and between 2003 and 2008 reveals that:

■ **Increasing the nation's exports holds out the potential of generating a significant number of good-paying jobs in the United States.** All told, U.S. exports supported 11.8 million jobs nationally and 7.7 million jobs in the top 100 metro areas in 2008. These jobs amounted to 8.3 percent of the nation's employment and 8.1 percent of all employment in the largest 100 metros in 2008. These are direct jobs in companies that sell abroad and, to some extent, indirect jobs in firms that are part of the supply chain of exporting companies.

■ **The largest 100 metropolitan areas produce most of the nation's exports.** Home to 65 percent of the nation's population, the 100 largest metropolitan areas produced an estimated 64 percent of U.S. exports in 2008, including 62 percent of U.S. manufactured goods and 75 percent of services. Export activity is highly concentrated. The 10 metropolitan areas with the highest value of exports produced about 43 percent of all the top 100 metro areas' exports in 2008, even though they contain just 38 percent of the population.

■ **Strong manufacturing and patent producing metropolitan areas generate the highest shares of exports from their output.** Manufacturing industries are the most export oriented, so metropolitan areas that specialize in manufacturing tend to export the largest shares of their GMP. Export-oriented metropolitan areas are also significantly more innovative, as defined by their rate of patent production. This may be explained by existing evidence that more innovative firms are more likely to export internationally and that activity reinforces innovation through competition.

■ **Four metropolitan areas doubled the real value of their exports between 2003 and 2008.** Houston doubled exports largely through sales of chemicals, while Wichita, KS doubled exports based on its powerful aviation cluster. Computer and electronics led the doubling of Portland's exports. New Orleans also doubled the value of its exports over the period, driven largely by oil refining.

■ **Export intensive industries pay higher wages than domestic oriented industries in large metropolitan areas.** In an analysis of the 94 of the largest 100 metropolitan areas, for every $1 billion in exports of a metro area industry, workers in that industry earn roughly 1 to 2 percent higher wages. Even those exporting industry workers without high school diplomas earn a higher wage. This wage effect can be seen even adjusting for worker characteristics, occupation, or the characteristics of the metropolitan area.

■ **Future export growth will come increasingly from large emerging markets.** Though Canada and Mexico are the nation's two largest trading partners, U.S. exports to Brazil, India, and China (the so-called BIC countries) have been increasing rapidly during the last decade, doubling in size between 2003 and 2008. The BIC countries are expected to account for about a fifth of the global gross domestic product in 2010, surpassing the United States for the first time. The metropolitan areas that produce the largest U.S. exports to the BICs are well-positioned to take advantage of the growth of these countries.

To reset its economic trajectory, the United States needs to connect the macroeconomic goal of increasing exports with the metropolitan reality of export production. Public and private sector leaders at the metro level need to collaborate and engage actively to leverage already extant export concentrations to create good paying jobs at home.

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## Introduction

In the beginning of 2010, with the U.S. economy struggling to produce output or jobs, President Obama devoted a portion of his State of the Union Address to "fixing the problems that are hampering our growth." One of these problems, he said, was a lack of exports.[1] The president linked an increase in exports to an increase in jobs, stating:

> So tonight, we set a new goal: We will double our exports over the next five years, an increase that will support two million jobs in America. To help meet this goal, we're launching a National Export Initiative that will help farmers and small businesses increase their exports, and reform export controls consistent with national security.[2]

The following March, the Obama administration released a more formal list of goals including: greater access to financing for exporters through the Export-Import Bank; more aggressive pursuit of U.S. interests in treaties and trade agreements; and an increased effort by the Foreign Commercial Service to assist U.S. firms in identifying export opportunities.

As it turns out, the doubling of exports in a five year period is extremely rare in the United States.[3] In real terms, such a doubling has occurred just three times in American history and not since 1949, when exports were twice as high as they were in 1944, a very atypical period. Focusing on the ambitious nature of the goal, however, misses the larger point: *Any* increase in U.S. exports would benefit the nation, so the federal government is right to think about maximizing exports. More importantly, it is up to local leaders, in businesses and government, to assess their own strengths and weaknesses and address them to sell to foreign markets.

Increasing exports is one key strategy for addressing current and past structural economic deficiencies. Even before the protracted recession that soured the U.S. economy, a number of longer term problems have plagued the country: declining median wages; increasing inequality; and ample fluctuations in the business cycles. The bursting of the most recent bubble, in housing and its finance, has resulted in the most stubborn period of high unemployment since the early 1980s and perhaps, by the time it ends, the Great Depression.

If the United States is to achieve a significant surge in exports—whether a doubling or not—metropolitan areas will play a huge role. Reflecting their high concentration of the nation's human and physical capital, metropolitan areas produce 84 percent of the nation's exports, making them the points of leverage for scaling up trade with the wider world. The 100 largest metropolitan areas alone account for over 64 percent of the nation's exports, including 75 percent of its service exports. Moreover, almost every large metro produces a disproportionately large share of U.S. exporting value in at least two export industries. The average large metro has roughly seven export clusters.[4]

Some of these metro export clusters are truly large. Exports from textile manufacturing as a percentage of Chattanooga, TN's economy are almost 18 times the national average; exports from leather manufacturing in Portland, ME are 16 times larger in relation to its economy than to the U.S. economy. Computer and electronics manufacturing is hugely concentrated in Portland, OR's "Silicon Forest," which has sales 12 times larger than the size of its economy would predict.

And yet, this distinctive role of metropolitan areas is often ignored because the nation's political map does not correspond to its economic geography. Regional economies do not stop at congressional districts or state boundaries; metropolitan statistical areas, which comprise counties with residents that commute to central cities, were designed to approximate regional labor markets. Further, current measures of exports from metropolitan areas are based on origin of movement data and not production data, and services exports are neglected altogether. So to considerable extent, metropolitan leaders interested in nurturing their export clusters lack a full and accurate database of industrial export activity. One ambition of this report is to provide new data at the

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### What is a U.S. Export?

A U.S. export is the sale of a good or service made in the United States to a person or business residing in a foreign country. To provide a common example, in 2008, 376,780 automobiles made in the United States left the Port of New York-New Jersey destined for places like Germany, France, the United Kingdom, and China.

Service exports are not always as obvious. If a Canadian residing in Canada takes a trip to Rochester, NY, she generates U.S. exports to Canada for each dollar she spends in Rochester—on things like taxis, restaurants, entertainment, clothing, and lodging.

The expenditures of foreign students studying in the United States are education exports for the United States. The payments made by people and companies from outside of the United States to U.S. companies or individuals for the right to use their patents, trademarks, or copyrights are U.S. exports of royalties.

What makes something a U.S. export is not where the transaction takes place, but whether or not the buyer is outside the United States. For example, if a U.S. company sells goods or services to its subsidiary in India or to an Indian business in India, it sends U.S. exports to India in both cases.

This notion of a U.S. export focuses on international trade, which is a subset to the broader definition of an export sector or traded sector in a metro area. In regional economic development, export sectors are those that bring income into a metro area from outside of the metro area, whether domestically or internationally. This paper focuses on just that segment of a metro area's export sector that sells a good or service to a foreign resident or business. ■

metropolitan scale in terms of where exports are produced and in what industries.

Beyond that, the study describes the nation's export landscape in detail: The first section discusses why exports matter nationally and provides some national context for the metropolitan-centered discussion. Next, the study presents a summary of the methods used to generate the export estimates. The findings showcase the level and importance of exports to each of the 100 largest metros, including recent growth rates, most significant trading partners, jobs supported, and wages earned. Finally, a policy discussion is presented about what's required to support increasing exports.

## I. Background: Why Are Exports Important to the United States and Why Are Metropolitan Areas Important to Exports?

U.S. exports are goods and services that are sold in international markets (See Sidebar).[5] This means two things: Competition is usually more intense, forcing greater efficiency or innovation; and the scale of the market is larger, meaning that there are more potential customers for any given product, and products can be more specialized than they would otherwise be. These two factors—competition and scale—translate into more jobs and higher wages for workers in exporting industries compared to what would be the case if the same industry did not export.[6]

Increasing exports relative to imports is even more advantageous when a country, like the United States, imports more than it exports. In theory, a trade deficit situation should lead to a depreciation of the currency of the country with a trade deficit, but since the United States dollar is a "reserve currency" (used as a safe investment vehicle by investors around the world) the demand for U.S. dollars prevents the dollar from depreciating enough to aid the reduction of the trade deficit.[7]

At any rate, multiple benefits can be achieved through an increase in export activity.

### Exports Deliver Economic Growth and Jobs

Economists have argued at least since the 18th century that trade is linked to economic growth, and there is abundant evidence in favor of the theory.[8] Trade enhances growth by taking advantage of diverse productive capacities, and by encouraging specialization and economies of scale.[9] In addition, trade creates wealth even when trading partners are identical because of specialization through scale economies.[10] Many products with large upfront costs (like Hollywood movies, pharmaceuticals, solar technologies, computer processing microchips) simply could never be profitable if not for vast international markets, which allow producers to amortize the costs of producing a single product via sales at scale.[11]

There is also evidence that exporting makes companies more competitive.[12] Exporting forces companies to stay on the cutting edge of competition and exposes them to international best practices. Even if companies initially struggle in foreign markets, there is evidence that this intense competition forces them to improve over time. For example, Taiwanese exporting firms are more likely to invest in R&D and to witness faster productivity growth regardless of R&D.[13]

Exporting activity generates jobs. A recent economic report from the U.S. Department of Commerce estimates that, in 2008, 10.3 million jobs were supported by the entire chain of export production, including inputs and transportation.[14] The Commerce figure was produced using input-output tables, which relate an industry's supply and demand of products to and from other industries. This study estimated 11.8 million export related jobs in 2008, using a different method that multiplies the total number of jobs in an industry by the ratio of its export sales to its gross value added. Unlike the Commerce estimate, this study ignored the fact that imports are used in the production of some exports, which may explain the discrepancy.

### Export-Related Jobs Offer Good Pay to Workers at All Levels of Education

Wages are higher for exporting companies. Firms that produce for export markets pay more even after adjusting for the effects of firm size and capital intensity, even within the same industry.[15] Other research finds that in the 1990s wages were roughly 11 percent higher for exporting companies, adjusting for industry and state location, for both production and non-production workers.[16]

This export effect does not exclude the distributional consequences of import competition, when considering trade overall. Trade between countries with different skill distributions (i.e. the United States and China) can harm unskilled workers in the more developed country, even as overall living standards are enhanced.[17] This distributional problem can be partially resolved by spending a share of the gains from trade on those who lose out (such as unemployment insurance and retraining programs for displaced workers).

### Exports Could Contribute to the Rebalancing of the U.S. Economy and a Lower Trade Deficit

For the most of the last 20 years, the United States has witnessed strong economic growth and low unemployment in comparison with other developed countries.[18] Yet, the U.S. economy was affected by the wide fluctuations at the end of two business cycles, the so called IT bubble of the late 1990s and the housing bubble that ended between sometime during 2006 and 2007. Meanwhile, in 2006 house-hold income inequality reached its post-World War II peak.[19] Real median income in 2008 fell below 1999 levels.[20] These three conditions—a tepid rise in living standards, increasing inequality, and bubble economies—are embedded in the consumption driven American economy.

In 1982, U.S. residents spent 86 cents of every dollar of after-tax income, but the intensity of consumption grew steadily such that by 2005, that share had reached 95 cents of every dollar.[21] All this spending depleted savings, which dropped precipitously over the time period from over 10 percent in the early 1980s to just 1.7 percent in 2005.[22] At the same time, an increasing share of consumption involved the purchase of imports. While the value of U.S. total imports was eight percent higher than the value of U.S. total exports in 1982, by 2005, the difference was 36 percent, the highest gap since 1960.[23]

With minimal household savings, domestic investment declined over the last two decades relative to the size of the economy. The United States invested about 7.3 percent of GDP in the 2000s, much less than the 9.4 percent rate of the 1970s.[24] Moreover, from 2000 to 2007, private manufacturing invest-ment as a share of GDP was just 0.26 percent per year compared to 0.37 percent during the 1990s. At the same time, foreign investment compensated to some extent, though more in the real estate sector. For example, Chinese holdings represented 6 percent of all federal agency debt and 29 percent of foreign-held agency debt in 2007, making China the largest foreign holder of Fannie Mae and Freddie Mac debt.[25]

The externalization of risk is another major problem with trade deficits. A large portion of the dol-lars spent on imports end up being re-invested back into the United States and that process increases the risk of bubbles. No sector can sustain limitless growth, and as the safest and most valuable invest-ments become saturated with funding, the excess liquidity begins to seep into riskier and riskier propo-sitions like no-income-no-asset subprime mortgage derivatives. The economists Joshua Aizenman and Yothin Jinjarak have shown that current account deficits have coincided with and contributed to rapid housing price appreciation across OECD countries between 1990 and 2005.[26]

While the United States based its growth on private consumption over the last three decades, the other developed countries exploited foreign demand. Over the last 30 years, private consumption, as a share of GDP, increased by seven percentage points in the United States, while total exports grew by only two percentage points. The other large developed countries, Canada, France, Germany, Italy, Japan, and the United Kingdom, maintained an almost constant share of private spending, but increased their share of total exports in GDP by seven percentage points.[28] In 2008, the U.S. total exports were only 12.7 of domestic production, in comparison with 29.7 percent in the other large developed countries. Moreover, as a recent Brookings report shows, this underperformance is not entirely explained by the size of the U.S. economy and its distance from trading partners.

There are a number of potential explanations for why the United States under-exports. First, the dol-lar is over-valued relative to the currencies of a number of important U.S. trading partners.[29] In addi-tion, U.S. companies have been focused on catering to the large and growing U.S market. About one percent of U.S. companies exported in 2008.[30] It seems that many small and medium companies lack information regarding exports and perceive exporting as a risky endeavor.[31] Finally, many countries still put up significant trade barriers against U.S. companies. In the absence of free trade agreements with emerging countries, U.S. companies had additional incentives to locate production abroad in order to

take advantage of these foreign markets. For example, while nominal total exports grew by 10 percent annually between 1994 and 2007, nominal sales of U.S. affiliates located in foreign countries increased by almost 18 percent a year during the same period.[32]

Whatever the reasons why the United States is less export-oriented than other countries, increasing exports relative to imports can be part of the solution to many long-standing difficulties.

## A Profile of Exports in the United States

The United States exported 1.8 trillion dollars in 2008 in total, out of which 1.6 trillion were domestic goods and private services. 69.9 percent of the 1.6 trillion exports were goods produced in the United States and 28.8 percent came from private services. Total exports from the United States grew 46 percent over the previous five years, double the import growth rate, in real terms.[33] Overall, in 2008, the United States ranked third in the world in terms of goods exports and first in terms of service exports.[34] American companies, such as General Electric, are the generators of these exports (See Sidebar).[35]

Though still a major exporter in terms of sheer value, the United States has been losing ground in terms of its share of goods exports, as one would expect based on the rapid economic growth of many developing countries. In 1948, the United States produced roughly 21.7 percent of the world's goods exports, but 60 years later that share dropped to 8.2 percent. Over the last five years, products made in China, India, Brazil, and the Middle East have made up an increasing share of world goods exports.[36]

Accompanying the decline in U.S. dominance in goods exporting is the steady rise of service exports from the United States. As U.S. jobs in services shifted from 65 percent of all jobs in 1960 to 84 percent in 2009, commercial service exports increased from only 15.8 percent of total exports to 31 percent.[37] This increase in service exports has surpassed the increase in service imports. By 2007, the value of United States service exports was 40 percent higher than the value of service imports.[38] Moreover, the United States has been a global leader in commercial service exports, selling $525.8 billion worth to foreign residents in 2008.[39] This represented 13.8 percent of global commercial service exports, making the United States by far the world's dominant service exporter.[40]

Business, professional and technical services, such as advertising, architecture, and industrial engineering were the fifth largest U.S. export category in 2008 (See Table 1). In fact, half of the top 10 major export categories in 2008 were services.

Still, despite the rise in services, manufacturing still accounts for the lion's share of U.S. exports–accounting for 62 percent in 2008. Transportation equipment exports, mostly manufactured aircraft and aircraft parts, followed by automobiles and to a lesser extent ships, have been the largest exports category since 2002, when it replaced computers and electronics. Chemicals manufacturing, including exports of plastics, medicine, pharmaceuticals, and various compounds, were also a major source of exports in 2008.

From 2003 to 2008, U.S. exports grew by 9.2 percent annually, adjusting for industry specific inflation, compared to 2.5 percent real GDP annual growth.[41] As Table 1 shows, of the ten largest industries, all grew faster than GDP over the period. The fastest growing industries were in petroleum refining and the mining of coal, which grew by 26.2 and 24.8 percent, respectively. Outside of raw materials, the fastest export growth was from the publishing industry–which includes books, newspapers, and software– which increased by 24.4 percent annually, from a base of just 360 million in 2003 to 799 million in 2008. Rapid growth–19.2 percent annually– was also found in the sub-category of other business, professional, and technical services, which includes things like highly specialized equipment repair services, legal services, internet trade services, architectural and engineering services, and advertising. Exports from telecommunication services and miscellaneous manufacturing, which includes medical equipment manufacturing, also grew faster than 14 percent annually. Meanwhile, exports from apparel manufacturing declined by 7.9 percent.

### General Electric–A Leading U.S. Exporter

General Electric (GE) is not only one of the largest U.S. companies, but also a leading American exporter. General Electric exported $18 billion worth of goods and services from the United States in 2009. The company sales abroad include jet engines, gas turbines, locomotives, as well as media content and financial services.

General Electric has taken advantage of the rising tide of the emerging markets. While developed countries such as Canada, France and Germany are still some of its major export markets, Brazil and China figure among the top five destinations of GE products made in the United States.

Some of the GE facilities in the United States produce mainly for foreign markets. For example, GE Energy's Greenville, SC facility manufactures and assembles gas turbines for export. In recent years, this plant exported over 70 percent of its production. General Electric's aviation factories in Cincinnati, OH, and Durham, NC are also export-focused. Other plants, such as GE's locomotive manufacturing facilities around Erie, PA have also been exporting much of their volume in recent years.

General Electric's exports support not only jobs with GE, but also jobs with all its numerous suppliers. For example, the GE plant in Greenville, SC buys equipment from 74 small and medium sized businesses for every single 9FA gas turbine built. ■

**Table 1. Top 10 Exports in the United States in 2008 and their Recent Growth Rates**

| Rank | Export Category | Exports, 2008, (blns USD) | Annual Real Growth Rate of Exports, 2003-2008 |
|------|-----------------|---------------------------|-----------------------------------------------|
| 1 | Transportation Equipment | 202.0 | 10.6% |
| 2 | Chemicals | 165.8 | 6.8% |
| 3 | Computer and Electronic Products | 136.4 | 5.6% |
| 4 | Machinery | 133.7 | 12.6% |
| 5 | Business, Professional, and Technical Services (e.g. Consulting, Advertising, Architecture services) | 113.5 | 10.8% |
| 6 | Travel and Tourism | 110.1 | 8.0% |
| 7 | Royalties from Intellectual Property | 91.6 | 13.3% |
| 8 | Agriculture | 62.7 | 6.2% |
| 9 | Financial Services | 60.2 | 17.0% |
| 10 | Port and Freight Services | 58.9 | 6.7% |

*Note: Agricultural exports include agricultural products and livestock exports. For the real growth rate, goods industries were adjusted using BLS's Producer Price Indexes and the 2010 BEA's export index for agriculture. Services exports were adjusted using the BEA's service exports price indexes.*
*Source: USITC; BEA, U.S. Trade in Services, 2009; and BLS, 2010.*

**Table 2. U.S. Export Markets Ranked by U.S. Exports and Share of U.S. Exports, 2008**

| Rank | Country | U.S. Exports (blns USD, 2008) | Share out of U.S. Exports |
|------|---------|-------------------------------|---------------------------|
| 1 | Canada | 255 | 15.8% |
| 2 | Mexico | 149 | 9.3% |
| 3 | UK | 106 | 6.6% |
| 4 | Japan | 100 | 6.2% |
| 5 | Germany | 75.3 | 4.7% |
| 6 | China | 74.7 | 4.6% |
| 7 | Netherlands | 51 | 3.1% |
| 8 | Korea | 44 | 2.8% |
| 9 | France | 43 | 2.7% |
| 10 | Brazil | 41 | 2.5% |
| | EU-27 | 431 | 26.8% |
| | U.S. Exports | 1,609 | 100% |

*Source: USITC, 2010 and BEA, U.S. Trade in Services, 2009*

The multi-decade changes discussed above are in large part driven by changes outside of the United States, especially the rise of China, India, and other nations.

### A Profile of U.S. Trading Partners

A significant part of U.S. exports is purchased by residents in developed countries, and the European Union, taken as whole, is the main U.S. trading partner. Its 27 members consume more than one quarter of U.S. exports. In terms of individual countries, Canada is the United States' top trading partner, buying almost 16 percent of U.S. exports in 2008. Illustrating the importance of developed nations, Canada, Japan, Korea and the European Union purchase more than 51 percent of U.S. exports (See Table 2).

Despite the importance of these long-established markets, U.S. exports to the BIC countries—Brazil, India, and China—have increased rapidly between 2003 and 2008, more than doubling in size, in real terms. These export markets are also gaining share, from 5.9 percent of U.S. exports in 2003 to 8.8 percent in 2008. This group of countries will be increasingly the main source of additional demand in the world. For example, if their GDPs are combined, based on the IMF forecast, they are expected to account for about a fifth of global GDP in 2010, which would surpass U.S. GDP for the first time.[42]

## The Role of Metropolitan Areas in the National Economy and its Exports

Like all industrialized countries, the United States is largely composed of metropolitan areas, which are cities surrounded by lower density areas. It is the aggregation of these diverse metropolitan areas, including their distinct geographies, industrial specializations, administrative and regulatory systems, and physical and human capital that shape the economic vitality of the nation.[43] Accordingly, developing an understanding of which places succeed in exporting and in what export industries is essential to inform a national strategy to boost exports. As economist Paul Krugman put it:

> One of the best ways to understand how the international economy works is to start by looking what happens inside the nations. If we want to understand differences in national growth rates, a good place to start is by examining differences in regional growth; if we want to understand international specialization, a good place to start is with local specialization.[44]

In short, metropolitan strengths and weaknesses determine the strengths and weaknesses of the national economy.

Metropolitan areas are the nation's hubs of commerce and innovation and the ultimate source of much of its prosperity. Metropolitan areas work in this way by concentrating productive assets.[45] As the English economist Alfred Marshall argued back in 1890, concentrated industries exhibit benefits that no one company can expect to capture by facilitating access to shared ideas, skills, and transactions. As it turns out, there is considerable empirical evidence to support Marshall's theoretical contentions, as urban economists have documented for years.[46]

These advantages of metropolitan location are relevant to exporting in a number of ways. At the most basic level, metropolitan areas offer a large pool of workers to draw from, matching specific worker skills and training to industry needs.

Most exports require the cross-border movement of goods and people, and in this, metropolitan areas are crucial. The 100 largest metropolitan areas also move 79 percent of the nation's air cargo.[47] Over the course of 2009, just 26 metropolitan areas accommodated roughly 75 percent of domestic air travelers, and 94 percent of international passengers landed in 20 metro areas.[48]

Research on U.S. exports has found that the introduction of innovative products often precedes exports, and it is well documented that metropolitan areas are the home to most inventors of patents and a disproportionate share of research and development, science, and even venture capital investments.[49] Finally, there is evidence that export-oriented industries produce more patents if they are located near other firms in the same industry.[50] Clusters seem to operate just as Marshall described, by leveraging access to labor, suppliers, and ideas.[51] While clusters are not limited to urban or even metropolitan areas, export industry clusters are much more likely to be found in the counties of metropolitan areas.[52]

Despite these export strengths, no metropolitan area has been immune to the economic downturn that has gripped the nation, despite its varying severity.[53] With a sluggish domestic economy, metropolitan businesses should look overseas to fill the gap in demand.

From a longer-term perspective, however, increasing a metropolitan area's export orientation is likely to create higher paying jobs—and not just for the most highly educated. Local metropolitan leaders should be concerned with increasing the export intensity of existing companies rather than simply recruiting new ones, and in recruiting should target industries that overlap with existing firms in the area. There is evidence that exporting firms located in the same county as other firms in their industry experience higher productivity growth.[54] These features of clusters provide an incentive for local economic development experts to attract or grow companies in the export industries where they already have strengths.

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## II. Methods Used in Report

T his study examines U.S. exports produced in the top 100 metropolitan areas.[55] While the Census Bureau (Census) and the International Trade Administration (ITA) have been compiling metropolitan goods exports since 1995, these data do not accurately reflect the origin of production.[56] They are allocated based on origin of movement declared by the exporter, which is not always the place where the good was produced. In addition, if the exported goods are consolidated, the metro export series assigns them to the metro area where the consolidation point is located.[57] Last but not least, the Census--ITA metro exports data are limited only to merchandise trade,

and do not include service exports, which constitute roughly a third of total U.S. exports. For these reasons, this study generates new estimates of exports from metropolitan areas, which are more accurate and comprehensive than any measure publicly available.

To generate estimates of metropolitan exports, the general technique was to allocate U.S. domestic exports for individual industries to metropolitan areas based on the metropolitan areas' share of national value added for each of those industries. This approach assumes that if Wichita, KS produces 20 percent of the national value added of transportation manufacturing, then this metro area also exports 20 percent of U.S. transportation equipment.[58] In the case of trading partners, this method apportions U.S. exports associated with an industry sold to a particular country to each of the 100 largest metro areas in proportion with the metro share of output produced by that same industry to the national total. So, in the hypothetical Wichita example, if the U.S. exported $100 million to Turkey in transportation equipment in 2008, Wichita would be credited with exporting $20 million (i.e. 20 percent) to Turkey in transportation equipment in 2008. Thus, a metro's rank for share of exports in a particular industry to a particular U.S. trading partner is the same as that metro's overall ranking in exports in that industry.

One challenge with this method is that service exports, which are measured by cross-border trade surveys from the Bureau of Economic Analysis, do not report industries but rather service categories like architectural services, computer services, financial services, freight servies, and rights to show films. These categories were matched up with the relevant North American Industrial Classification System (NAICS) codes, using information provided in BEA documents. For three difficult cases, supplementary resources were used. Internal Revenue Service (IRS) data on corporate income by industry from royalties was used to first link royalties to NAICS.[59] Likewise, data from a BEA satellite account was obtained for travel and tourism to insure that national exports were allocated accurately to industries. For education services, this study calculated the metropolitan area's share of foreign university students based on data from the Institute of International Education (IIE).

### Accuracy of Data

Though caution should be used in interpreting these estimates, there is reason to believe that they accurately reflect export activity within a reasonable margin of error and represent a considerable improvement in accuracy over the ITA origin of movement data.

First, these estimates capture the reality that metros that export a larger share of their goods outside of their region are likely to export a larger share of their goods to other countries. The Commodity Flows Survey from the U.S. Department of Transportation allows one to calculate the share of goods that are sent externally for 59 of the 100 largest metropolitan areas for the year 2007. This export orientation measure is positively and significantly correlated with the Brookings export orientation measure, but it is negatively correlated with the ITA measure. In other words, the ITA data has no statistical association with an alternative measure of exports, while this study's data does.[60]

Second, according to the ITA metropolitan exports series, there are 15 metropolitan

areas out of the 100 largest that export a larger value of goods than they produce, at least in 2008. The highest percentage of goods produced as a share of exports using the Brookings data is a more plausible 84 percent, and the average was 54 percent as opposed to 67 percent using the ITA data.

An analysis of the sources of the discrepancies between the ITA and Brookings estimates leads to the conclusion that the respondents to the Census origin of movement surveys, which form the basis of the ITA data, attribute the origin of exports to metropolitan areas that have ports and that are near Canadian and Mexican borders, regardless of whether or not the good was produced there. The metropolitan areas with the highest export to GMP ratios in the ITA were in states that bordered Mexico or Canada; metros in these bordering states were allocated an average of 54 extra percentage points to their exports to GMP ratio; this represented an extra $7 billion in exports, most of which is probably erroneous if interpreted as the origin of production. Many border metros serve as warehouse or consolidation points, and so the origin of movement method used by the ITA attributes origin to where the goods were temporarily housed. Furthermore, the Brookings goods exports data are strongly correlated with manufacturing employment, but the ITA data have no significant correlation with manufacturing. Given the outsized importance of manufacturing to exports, this result also favors using the Brookings data over the ITA data.[61]

### Generating Employment Estimates

The level of export related jobs was estimated based on the contribution of industry exports to industry GMP for each metropolitan area. This ratio, which one could call the metropolitan export intensity of the industry, was multiplied by the number of jobs in each metropolitan-industry to get the number of export related jobs in that metropolitan areas' industry. The export related jobs number is an estimate of the number of workers in each industry within a metropolitan area that are required to produce that industry's exports. To some extent, this figure captures jobs that supply export industries, since the export values are final sales numbers, which include the supply chain.[62]

### Generating the Relationship between Metropolitan Exports and Metropolitan Industry Wages

To estimate how individual wages are affected by working in a metropolitan industry that exports, individual data was obtained from IPUMS, which organizes data from the 2008 American Community Survey. The approach was to estimate the average effect of metropolitan industry exports on individual wages, adjusting for other relevant factors that affect wages, such as the characteristics of the individual, his or her industry, his or her metropolitan area and occupational characteristics, and the level of education of his or her colleagues in the same industry within the metropolitan area.

The Brookings exports data for each of the 100 largest metropolitan areas is available at www.brookings.edu/metro/exports

## III. Findings

*1. Increasing the nation's exports holds out the potential of generating a significant number of good-paying jobs in the United States.* U.S. exports supported 11.8 million jobs nationally and 7.7 million jobs in the top 100 metro areas in 2008. These jobs amounted to 8.3 percent of total employment in the nation and 8.1 percent of all jobs in the largest 100 metropolitan areas.

Export related employment is not only jobs in companies that sell abroad, but also in firms that are part of the supply chain of the exporting companies. For example, the export related jobs in transportation equipment are jobs in companies that sell cars, aircraft, and parts abroad and jobs in the domestic firms that supply parts to these companies. Because this study estimates the export related jobs based on export sales, the export related jobs only partially reflect the jobs in the companies from the supply chains of exporting companies. Further, these job figures do not include jobs in the local services (retail, restaurants) that are generated by the spending of those employed by exporting companies.

Southern and Western large metropolitan areas hold 56 percent of export related jobs from the top 100 metropolitan areas. Midwestern large metro areas have 24 percent of the export related jobs

**Table 3. Export Related Jobs and the Share of Export Related Jobs out of Metropolitan Employment, 2008**

| Metropolitan Area | Total Jobs from Exports in 2008 | Rank Export Related Jobs | Share of Export Related Jobs of Metro Employment, 2008 | Rank Percentage of Jobs from Exports |
|---|---|---|---|---|
| Los Angeles-Long Beach-Santa Ana, CA | 560,475 | 1 | 9.8% | 23 |
| New York-Northern New Jersey-Long Island, NY-NJ-PA | 481,946 | 2 | 5.6% | 87 |
| Chicago-Naperville-Joliet, IL-IN-WI | 397,924 | 3 | 8.7% | 43 |
| Dallas-Fort Worth-Arlington, TX | 303,514 | 4 | 10.0% | 21 |
| Detroit-Warren-Livonia, MI | 239,910 | 5 | 12.5% | 7 |
| Houston-Sugar Land-Baytown, TX | 235,193 | 6 | 8.9% | 38 |
| Boston-Cambridge-Quincy, MA-NH | 223,070 | 7 | 8.9% | 37 |
| San Jose-Sunnyvale-Santa Clara, CA | 212,157 | 8 | 22.7% | 1 |
| Philadelphia-Camden-Wilmington, PA-NJ-DE-MD | 201,634 | 9 | 7.1% | 65 |
| Seattle-Tacoma-Bellevue, WA | 196,000 | 10 | 10.7% | 16 |
| | | | | |
| Honolulu, HI | 18,218 | 91 | 3.6% | 98 |
| Augusta-Richmond County, GA-SC | 17,602 | 92 | 7.6% | 60 |
| Provo-Orem, UT | 17,477 | 93 | 8.9% | 39 |
| Colorado Springs, CO | 17,232 | 94 | 5.9% | 82 |
| Modesto, CA | 17,177 | 95 | 9.7% | 25 |
| El Paso, TX | 17,114 | 96 | 5.8% | 85 |
| Bradenton-Sarasota-Venice, FL | 15,241 | 97 | 5.5% | 88 |
| Lakeland-Winter Haven, FL | 13,236 | 98 | 6.1% | 80 |
| McAllen-Edinburg-Mission, TX | 8,695 | 99 | 3.8% | 97 |
| Cape Coral-Fort Myers, FL | 6,006 | 100 | 2.8% | 100 |
| **Largest 100 Metro Areas** | **7,688,744** | | **8.1%** | |
| **United States** | **11,854,390** | | **8.3%** | |

*Source: Brookings Analysis of data from BEA, Moody's Economy.com, USITC, IIE, and IRS.*

from the largest 100 metro areas, larger than the 20.9 percent share of the export volume of the same group. The concentration of their exports in manufacturing partly explains this result. For every percentage point increase in the manufacturing share of total employment, the export share of employment increases by 0.8 percentage points.

The large metropolitan exporters have the most export jobs. For example, the counties in greater metropolitan areas of Los Angeles and New York had almost one million export related jobs total in 2008 (See Table 3). Computer and electronics sales abroad supported the largest number of jobs in Los Angeles (121,000), where the percentage of export jobs in computer and electronics manufacturing is roughly twice as high as the national share. Its famous film and television industry, which has ten times the number of export jobs as a percentage of all employment than the nation, generates an estimated 41,000 jobs from exports.

In the New York metropolitan area, jobs in business and professional services generated the largest number of jobs (70,000), in large part because of a disproportionate share of jobs in management and consulting, R&D, computer services, and telecommunications. New York, of course, also has a major financial sector cluster, and roughly 36,000 of its jobs in finance are supported by exports.

Export related jobs are a large part of the job base in several metropolitan areas in the United States. For example, in San Jose, almost 23 out of 100 metro jobs are supported by exports. Seventy percent of the export related jobs reside in the computer and electronics industry that fuels the San Jose economy and represents its largest industry cluster. Likewise, Wichita's workforce is heavily dependent on export markets. Exports support 22 out of every 100 jobs in the metropolitan area of

Wichita. Of those 22 jobs, 15 come from Wichita's massive aviation cluster, which specializes in non-commercial, non-military planes.
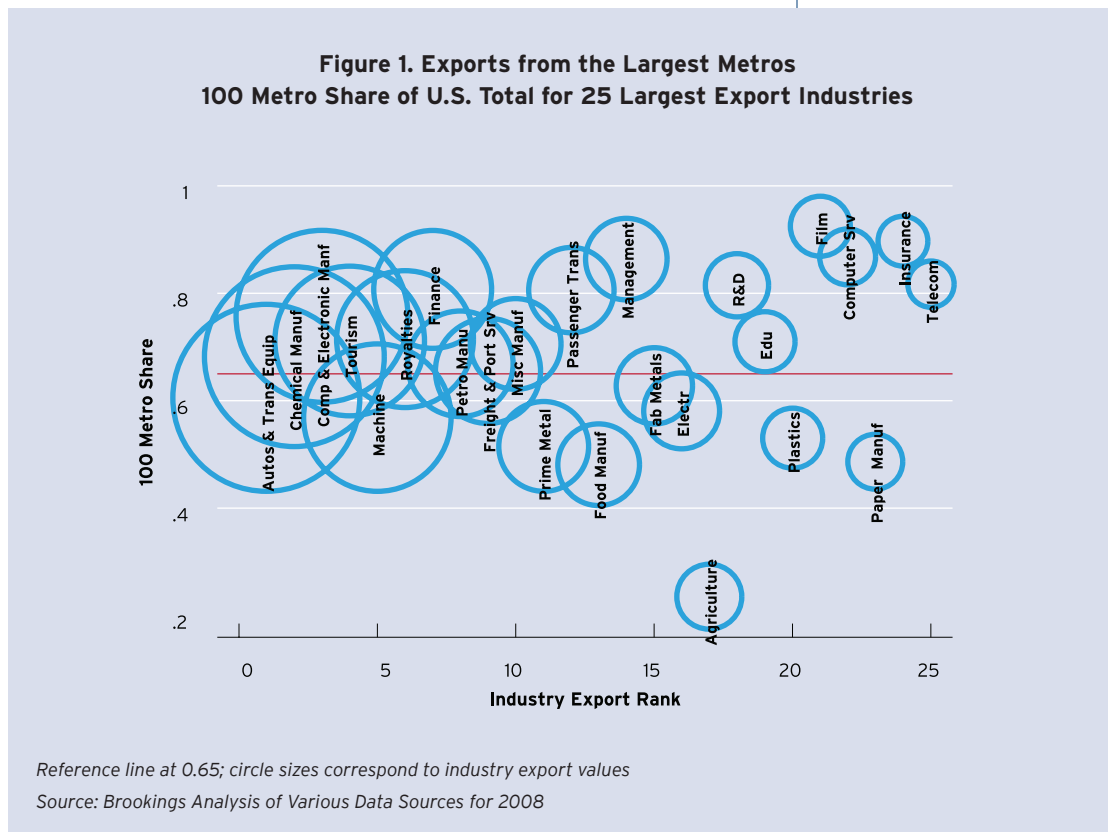
In some cases, export related employment is not nearly as impressive as export sales. For example, metros such as New Orleans and Baton Rouge that rely heavily on petroleum refining exports do not have nearly as many export related jobs as their export sales would predict. Only 6.8 percent of jobs in New Orleans and 5.8 percent of jobs in Baton Rouge are export related, despite overall export sales accounting for 18.1 and 18.8 percent, respectively, of Gross Metropolitan Product in 2008. Exports per job (or export productivity) can be extremely high in industries dealing with raw materials and commodities because of capital intensity.

***2. The largest 100 metropolitan areas produce most of the nation's exports.*** Home to 65 percent of the nation's population, the 100 largest metropolitan areas produced an estimated 64 percent of U.S. exports in 2008, including 62.3 percent of U.S. manufactured goods and 75 percent of services. Export activity is highly concentrated among the top 100 metropolitan areas. The 10 metropolitan areas with the highest value of exports produced about 43 percent of all the top 100 metro areas' exports in 2008 even though they contain just 38 percent of the top 100 metros' population.

More broadly, 83.6 percent of the U.S. population in 2008 resided in metros of all sizes, and these areas produced 83.7 percent of all exports, including 90.2 percent of services and 80.5 percent of goods.

The reason that the large metros' export share is slightly lower than their population share is that many export-oriented industries have characteristics that favor less dense areas; these industries include agriculture, mining, oil and gas extraction, and resource-dependant manufacturing like paper and primary metals. These producers require large spaces, which can be very expensive in the cities and suburbs of large metros, and they often emit noise, odors, or pollutants which are understandably kept away from residential areas through zoning and mining exports laws. Despite that, 25 percent of the nation's agricultural exports and more than a third of oil and gas exports are produced in large metropolitan areas, a reminder that metros function as fully regional economies made up of cities, suburbs, towns, and rural areas.
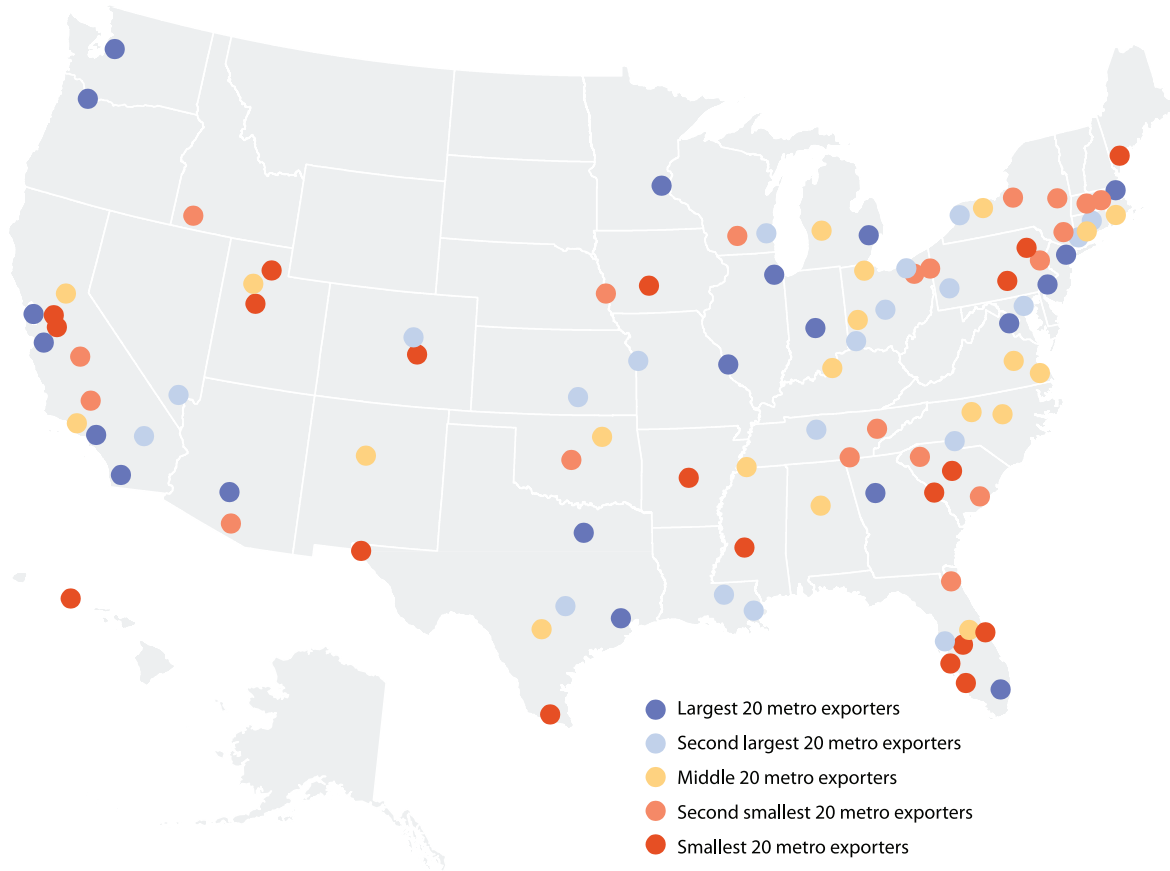
Still, most export industries, 31 out of 52 categories, are concentrated disproportionately in the largest 100 metros, higher than the 65 percent share of the largest 100 metros population (Figure 1). For example, three quarters of computer and electronics manufacturing is produced in the largest 100 metros. Other goods activities concentrated in large metros include publishing, print manufacturing, petroleum manufacturing, and apparel manufacturing. The smaller service exports, such as management and consulting, R&D, film and television, computer services, and insurance concentrate more than 80 percent of their production in the large metro areas.



**Figure 1. Exports from the Largest Metros**
**100 Metro Share of U.S. Total for 25 Largest Export Industries**

*Reference line at 0.65; circle sizes correspond to industry export values*
*Source: Brookings Analysis of Various Data Sources for 2008*

**Leading Metro Exporters**
The largest 10 exporters produced about 43 percent of all the top 100 metro areas exports in 2008, which is about 28 percent of all U.S. exports (See Table 4).[63] This is significantly more than their share of top 100 metro areas' population (38 percent), and slightly higher than their share of the Gross Metropolitan Product of the largest 100 metro areas (42. 6 percent). New York metro's exports are 100 times larger than the bottom exporter in the group, Cape Coral- Fort Myers, FL. Only a quarter of the top 100 metro areas exported more than the group average of $ 10.4 billion.

**Map 1. Metropolitan Exports, Top 100 Metro Areas, 2008**



- Largest 20 metro exporters
- Second largest 20 metro exporters
- Middle 20 metro exporters
- Second smallest 20 metro exporters
- Smallest 20 metro exporters

*Source: Brookings analysis of Moody's Economy.com, U.S.ITC, BEA, IRS, and IIE data*

The composition of the exports from the large exporters does not follow a particular sectoral pattern. While more than half of the New York exports are services, almost 70 percent of Houston's exports are manufactured goods. Seattle's main exporting industry is transportation equipment, concentrating almost half of the metro's exports. Chemical manufacturing is the biggest exporting industry in metros such as New York (21 percent of all the metro's exports) and Houston (27 percent). Chemical producers such as Dow Chemical, located in the Houston metro area contribute significantly to the prominence of chemical manufacturing in the exports of their metro economy.

Some of the top metro exporters' concentrations are quite large. Exports from petroleum and coal products, as a percentage of San Francisco's economy are seven times the national average; exports from transportation equipment in Seattle are four times larger in relation to its economy than to the U.S. economy.

**Table 4. U.S. Metro Areas Ranked by their Exports, 2008**

| Rank | Metro Area | Exports (bln 2008) | Exports, as Share of Top 100 Metro Total | Top Exporting Industry in the Metro Area | Share of Metro Exports |
|---|---|---|---|---|---|
| 1 | New York-Northern New Jersey-Long Island, NY-NJ-PA | 85.16 | 8.2% | Chemicals | 21.1% |
| 2 | Los Angeles-Long Beach-Santa Ana, CA | 78.54 | 7.6% | Computer and Electronics | 12.1% |
| 3 | Chicago-Naperville-Joliet, IL-IN-WI | 52.88 | 5.1% | Machinery | 13.3% |
| 4 | Houston-Sugar Land-Baytown, TX | 51.55 | 5.0% | Chemicals | 27.4% |
| 5 | Dallas-Fort Worth-Arlington, TX | 44.55 | 4.3% | Computer and Electronics | 16.4% |
| 6 | San Francisco-Oakland-Fremont, CA | 30.90 | 3% | Petroleum and Coal Products | 25.7% |
| 7 | Boston-Cambridge-Quincy, MA-NH | 28.80 | 2.8% | Computer and Electronics | 21.6% |
| 8 | Philadelphia-Camden-Wilmington, PA-NJ-DE-MD | 27.44 | 2.6% | Chemicals | 18.1% |
| 9 | Detroit-Warren-Livonia, MI | 26.91 | 2.6% | Transportation Equipment | 47.6% |
| 10 | Seattle-Tacoma-Bellevue, WA | 24.16 | 2.3% | Transportation Equipment | 48.7% |
| | | | | | |
| | **Top 10 Metro Exporters** | **450.90** | **43.5%** | | |
| | **Top 100 Metros** | **1,036.88** | | **Transportation Equipment** | **11.8%** |
| | **United States** | **1,609.41** | | **Transportation Equipment** | **12.6%** |

*Source: Brookings analysis of Moody's Economy.com, U.S.ITC, BEA, IRS, and IIE data*

**3. Strong manufacturing and patent producing metropolitan areas are the most export oriented.**
Manufacturing industries are the most export oriented, and so metropolitan areas that specialize in manufacturing tend to export the largest shares of their GMP. Export oriented metropolitan areas are also significantly more innovative, defined by their rate of patent production. This finding may be explained through existing evidence that firms that are more innovative are more likely to export internationally and exporting activity reinforces innovation through competition.

Overall, the top 100 metro areas export about 10.3 percent of their production, which is less than the national average of 11.4 percent.[64] Metro exports, as a share of the metro output, range from 4.1 percent in Cape Coral, FL to 27.8 percent in Wichita, KS, with an average of 10.9 percent across the top 100 metros (Table 5).

This reflects a wide spatial distribution among metro areas in terms of export intensity, with the Midwestern metros standing out as particularly export oriented (See Map 2). The Southern and Western metros follow in terms of the share of their output exported. The Northeastern metro areas rank lower in the group, with no metropolitan area from this region being among the 20 most export oriented metro areas.

The more export oriented metro areas are manufactured based economies.[65] For example, 65 percent of Wichita's exports are transportation equipment, mainly airplanes and airplane parts (See Sidebar).[66] Portland, OR, San Jose, and Palm Bay, FL rely on computer exports in a similar fashion. In Oxnard, CA chemicals and computers are about 42 percent of all the metro's exports.

Most of the metropolitan areas that are less export oriented specialize in services. The least export intensive metro areas rely on travel and tourism or business services as the main exporting industries. All of these metros are either in the West or South. Their low export intensities reflect the fact that manufactured goods are more tradable than services in general. In addition, it may show that they sell their services to other places in the United States or that a large base of non-tradable services (i.e. retail trade, health care and social assistance, government and administrative services) is necessary to support tradable services.

Export orientation is linked to innovation In order to test whether or not metropolitan export orientation is related to innovation, this report obtained new patent data from the Strumsky Patent Applications Database, which, through the work of Deborah Strumsky, aggregates and classifies

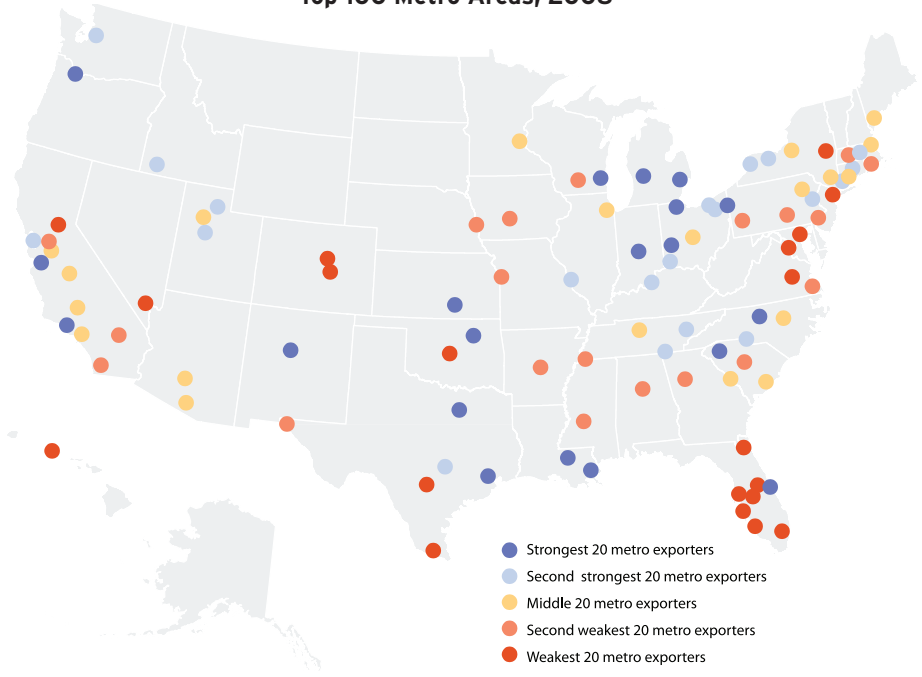## Wichita's Aviation Cluster—Its Main Source of Metro Exports

Wichita's top position in terms of exports share from output is the result of a shift towards foreign customers by its aviation companies. Overall, the U.S. general aviation industry has been growing its sales abroad, with 2009 being the first year when exports accounted for more than half of the industry sales. Large aviation manufacturers, such as Cessna and Hawker Beechcraft, are driving this trend in Wichita. They are helped by a myriad of suppliers that strengthen the export capability of the Wichita's aviation cluster.

Cessna's exports grew by 165.5 percent between 2005 and 2008 driven by strong sales into developing regions such as Latin America, Asia as well as the Middle East. The company's exports reached 44.1 percent of sales in 2008. Financing from the federal government will help Cessna to continue this trend. In 2009, the Ex-Im Bank authorized a $500 million direct-loan facility to Textron, Cessna's parent company to provide funds to assist in financing of exports.

Hawker Beechcraft's exports increased by more than 390 percent between 2004 and 2009, driven by sales to Europe, Latin America and Africa/Middle East. Exports were about half of the company's sales both in 2008 and 2009.

Cessna and Hawker Beechcraft's suppliers in Wichita, such as Cox Machine, Inc. and Perfekta benefited from the surging exports of the large companies. Cox Machine more than tripled its number of employees between 2003 and 2008, while Perfekta's employee headcount increased by 76 percent. While affected by the recession in 2009, Cox Machine's layoffs would have been much worse without Cessna and Hawker Beechcraft's sales abroad, according to Jason Cox, the Chief Technical Officer of Cox Machine. ◾



**Map 2. Metropolitan Exports, as a Share of Gross Metropolitan Product, Top 100 Metro Areas, 2008**

- Strongest 20 metro exporters
- Second strongest 20 metro exporters
- Middle 20 metro exporters
- Second weakest 20 metro exporters
- Weakest 20 metro exporters

*Source: Brookings analysis of Moody's Economy.com, U.S.ITC, BEA, IRS, and IIE data*

historic and current patent information from the U.S. Trademark and Patent Office by geography. It is well established that patent data is a proxy for product innovation. Using these data, the average large metropolitan area generated approximately 3,527 patents per year between 2001 and 2008; metropolitan performance ranged widely: McAllen TX produced 0.2 patents per thousand workers from 2001 to 2008, while San Jose CA produced 33.9.

It turns out that manufacturing-oriented metros create patents at much higher rates, despite having a lower rate of workers with college degrees (which is otherwise helpful for patenting). The average large metropolitan area had a patent rate of 3.6 granted patents per thousand workers from 2001 to 2008, while the 37 large metros with a manufacturing share of employment greater than or equal to 10 percent had a patent rate of 5.2. Those 63 metropolitan areas with less than 10 percent manufacturing share have patent rates of 2.7.

Yet, the link between innovation and exporting is not limited to manufacturing, and metropolitan areas that are more export-oriented have higher patent rates than less export oriented metropolitan areas with the same manufacturing share of employment. In Figure 2, metropolitan export shares of GMP were adjusted for state characteristics and the manufacturing share of employment. Comparing the adjusted export orientation of low, medium, and high innovators, defined in terms of patent generation per thousand workers, shows that export intensity is higher for more innovative metros (Figure 2).[68]
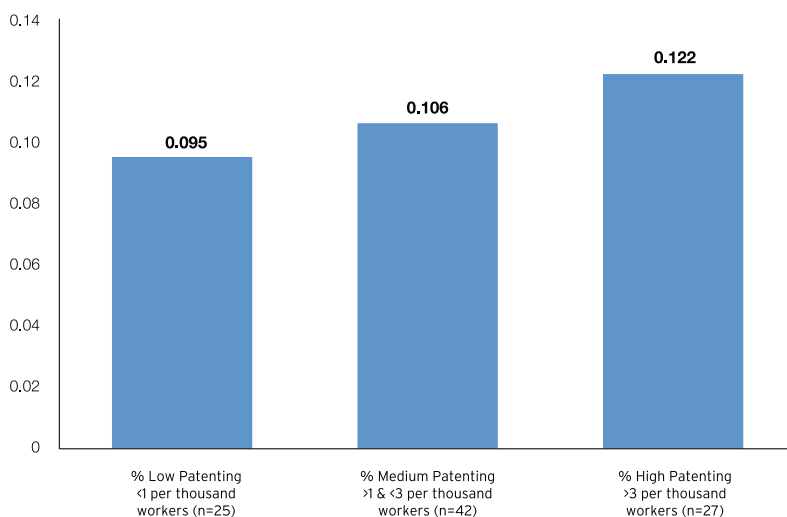
In the low patenting category, metro such as Cape Coral FL, Honolulu HI, McAllen TX, Miami FL, Oklahoma City OK, Little Rock AR, and Las Vegas NV export less than eight percent of what they produce. Of the metros that are in the middle in terms of patenting rates, Charlotte NC, Buffalo NY, Houston TX, Grand Rapids MI, and Indianapolis IN all export at least 11 percent of what they produce. In the highly innovative category, Cleveland OH, Dallas TX, Palm Bay FL, Oxnard CA, San Jose, and Portland OR all export

## Table 5. Metro Areas Ranked by the Share of Exports out of GMP, 2008

| Rank Export Intensity | Metro Area | Exports, as a Share of GMP | Highest contribution Industry | Industry Share |
|---|---|---|---|---|
| 1 | Wichita, KS | 27.8% | Transportation Equipment | 65.4% |
| 2 | Portland-Vancouver-Beaverton, OR-WA | 20.6% | Computer and Electronic Products | 57.0% |
| 3 | San Jose-Sunnyvale-Santa Clara, CA | 20.1% | Computer and Electronic Products | 54.8% |
| 4 | Baton Rouge, LA | 18.8% | Chemicals | 40.6% |
| 5 | New Orleans-Metairie-Kenner, LA | 18.1% | Petroleum and Coal Products | 45.0% |
| 6 | Youngstown-Warren-Boardman, OH-PA | 18.0% | Primary Metal Products | 37.4% |
| 7 | Greensboro-High Point, NC | 17.0% | Chemicals | 29.6% |
| 8 | Toledo, OH | 15.8% | Transportation Equipment | 33.8% |
| 9 | Indianapolis-Carmel, IN | 15.2% | Chemicals | 37.3% |
| 10 | Grand Rapids-Wyoming, MI | 15.1% | Transportation Equipment | 31.8% |
| | | | | |
| 91 | Tampa-St. Petersburg-Clearwater, FL | 6.8% | Computer and Electronic Products | 11.9% |
| 92 | Baltimore-Towson, MD | 6.8% | Chemicals | 14.8% |
| 93 | Jacksonville, FL | 6.4% | Travel and Tourism | 13.9% |
| 94 | Sacramento--Arden-Arcade--Roseville, CA | 6.3% | Computer and Electronic Products | 21.7% |
| 95 | Bradenton-Sarasota-Venice, FL | 6.3% | Transportation Equipment | 13.8% |
| 96 | Miami-Fort Lauderdale-Pompano Beach, FL | 6.1% | Travel and Tourism | 18.0% |
| 97 | McAllen-Edinburg-Mission, TX | 5.3% | Travel and Tourism | 14.8% |
| 98 | Honolulu, HI | 5.2% | Travel and Tourism | 31.9% |
| 99 | Washington-Arlington-Alexandria, DC-VA-MD-WV | 4.7% | Business, Professional, and Technical Services | 35.0% |
| 100 | Cape Coral-Fort Myers, FL | 4.1% | Travel and Tourism | 26.0% |
| | | | | |
| | **Top 100 Metro Total** | **10.3%** | **Transportation Equipment** | **11.8%** |
| | **United States** | **11.4%** | **Transportation Equipment** | **12.6%** |

*Source: Brookings analysis of Moody's Economy.com, USITC, BEA, IRS, and IIE data*

## Figure 2. Metropolitan Exports and Metropolitan Rates of Patenting, Top 100 Metro Areas, 2008



| | % Low Patenting <1 per thousand workers (n=25) | % Medium Patenting >1 & <3 per thousand workers (n=42) | % High Patenting >3 per thousand workers (n=27) |
|---|---|---|---|
| | 0.095 | 0.106 | 0.122 |

*Notes: The differences between the high patenting metros and the low and medium patenting metros are statistically significant (p-value is less than 0.05). The difference between medium and low patenting is marginally significant (p-value<0.09). Numbers on vertical axis are 2008 exports divided by GMP adjusted for state characteristics (i.e. state fixed effects), the number of granted patents from 2001 to 2008 as a percentage of the average level of employment in 2001 and 2008, and the 2008 share of employment in manufacturing. Patents rates are total granted patents from 2001-2008 divided by the number of workers in 2008. Similar results are obtained adding control variables for oil and coal fields, the share of employment in universities, and the share of employment in state and federal government. Brookings Analysis of the following data sources: The Strumsky Patent Applications Database, Moody's Economy.com, BEA, IRS, IIE, the Department of Energy, and the Census Bureau.*

at least 13 percent of what they produce. States like Texas, California, and Florida have metros on both ends of the extreme, implying that metropolitan specific characteristics are driving the differences.

### 4. Four metropolitan areas doubled the real value of their exports between 2003 and 2008.

There are four metropolitan areas that managed to surpass the president's goal of doubling exports, even adjusting for inflation (Table 6). Sales abroad originating from Wichita, Portland, New Orleans, and Houston grew at rates of 111.0 percent, 100.9, 100.8, and 99.8 percent respectively over the five years between 2003 and 2008. What's more, they all managed to rely on different industries for their growth. On a nominal basis, 20 metropolitan areas doubled their exports, but much of that growth was the result of extreme price inflation for oil, minerals, and metals.

The Wichita metropolitan area expanded its exports in transportation equipment manufacturing by $3 billion from a base of just $1.8 billion in 2003 (in 2008 dollars). This growth is attributable to its impressive aircraft industry cluster, which includes: Spirit AeroSystems with over 10,000 employees, Cessna Aircraft, and Hawker Beechcraft, each with over 5,000 employees, and, finally, Boeing and Bombardier, which have at least 2,000 employees working in Wichita.[69]

Meanwhile, two-thirds of Portland's growth in exports came from its computer and electronics manufacturers. Known colloquially as the "Silicon Forest," Portland's economy features a wide range of large and small companies in the IT sector, including Intel, TriQuint Semiconductor Inc, Jive Software, OpenSourcery, Webtrends Inc, i-Op, and Tripwire.[70]

New Orleans may be known for the recent misfortunes of Hurricane Katrina and the Gulf oil spill, but it has been an extremely successful exporter in recent years, even when adjusting for oil prices. Most of its export growth has come from the petroleum and coal products industries. Major exporters from the area include ConocoPhillips, Halliburton Energy Services, Inc., Murphy Oil USA, Valero Refining, Chalmette Refining LLC. Marathon Petroleum Company LLC.[71]

Houston also managed to double its exports, albeit just barely when adjusted for inflation. Its growth was mostly balanced across three industries, with 31 percent coming from chemicals manufacturing, 21.4 percent from machinery manufacturing, and another 13.4 percent from petroleum and coal products manufacturing. Its major chemical exporters include Dow Chemical, DuPont, Equistar Chemicals, and BASF. In machinery, WLS Drilling Products Inc., Shaffer Inc., and Deepsea Flexibles

#### Table 6. The 10 Metropolitan Areas with the Fastest Export Growth, inflation-adjusted 2003–2008

| Rank Real Growth | Metropolitan Area | Annual Real Growth Rate of Exports, 2003-2008 | Industry with Largest Contribution to Change | Percentage of Increase from Largest Industry |
|---|---|---|---|---|
| 1 | Wichita, KS | 22.3% | Transportation Equipment | 77.3% |
| 2 | Portland-Vancouver-Beaverton, OR-WA | 20.2% | Computer and Electronic Products | 67.2% |
| 3 | New Orleans-Metairie-Kenner, LA | 20.2% | Petroleum and Coal Products | 58.6% |
| 4 | Houston-Sugar Land-Baytown, TX | 20.0% | Chemicals | 31.6% |
| 5 | Provo-Orem, UT | 17.5% | Primary Metal Products | 45.3% |
| 6 | Bridgeport-Stamford-Norwalk, CT | 17.5% | Chemicals | 31.6% |
| 7 | Baton Rouge, LA | 16.6% | Chemicals | 39.9% |
| 8 | Hartford-West Hartford-East Hartford, CT | 16.4% | Transportation Equipment | 55.8% |
| 9 | Las Vegas-Paradise, NV | 16.2% | Travel and Tourism | 36.8% |
| 10 | Austin-Round Rock, TX | 16.0% | Computer and Electronic Product s | 42.0% |
| | **Top 100 Metropolitan Areas** | **8.7%** | **Transportation Equipment** | **14.0%** |
| | **United States** | **9.2%** | **Transportation Equipment** | **13.8%** |

*Source: Brookings analysis of Moody's Economy.com, U.S.ITC, BEA, IRS, and IIE data. Price Indexes from Bureau of Labor Statistics and BEA; 2003 values adjusted using the BLS's Producer Price Indexes for each goods industry, with the exception of agriculture. Agriculture and service exports were adjusted using the BEA export price indexes.*

**Figure 3. Change in Jobs and Change in Exports 2003 to 2008 for 100 MSAs**
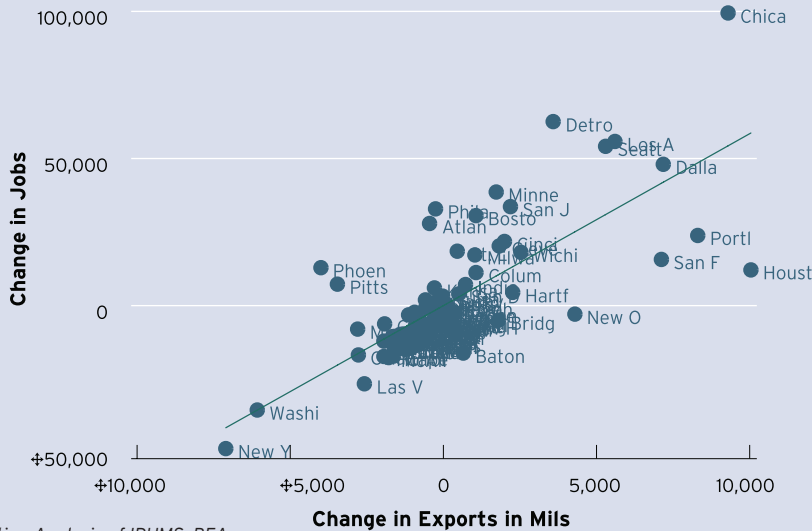
*Brookings Institution Analysis of IPUMS, BEA, Moody's Economy.com, IIE, IRS, USITC.*
*Coef=5.8, T-statistic=5.7, R-sq=.80;*
*Adjusts for change in domestic GMP, errors clustered by state*

have production in Houston; in the refining industry, it has Shell, Pasadena Refining Systems, Houston Refining, and others.[72]
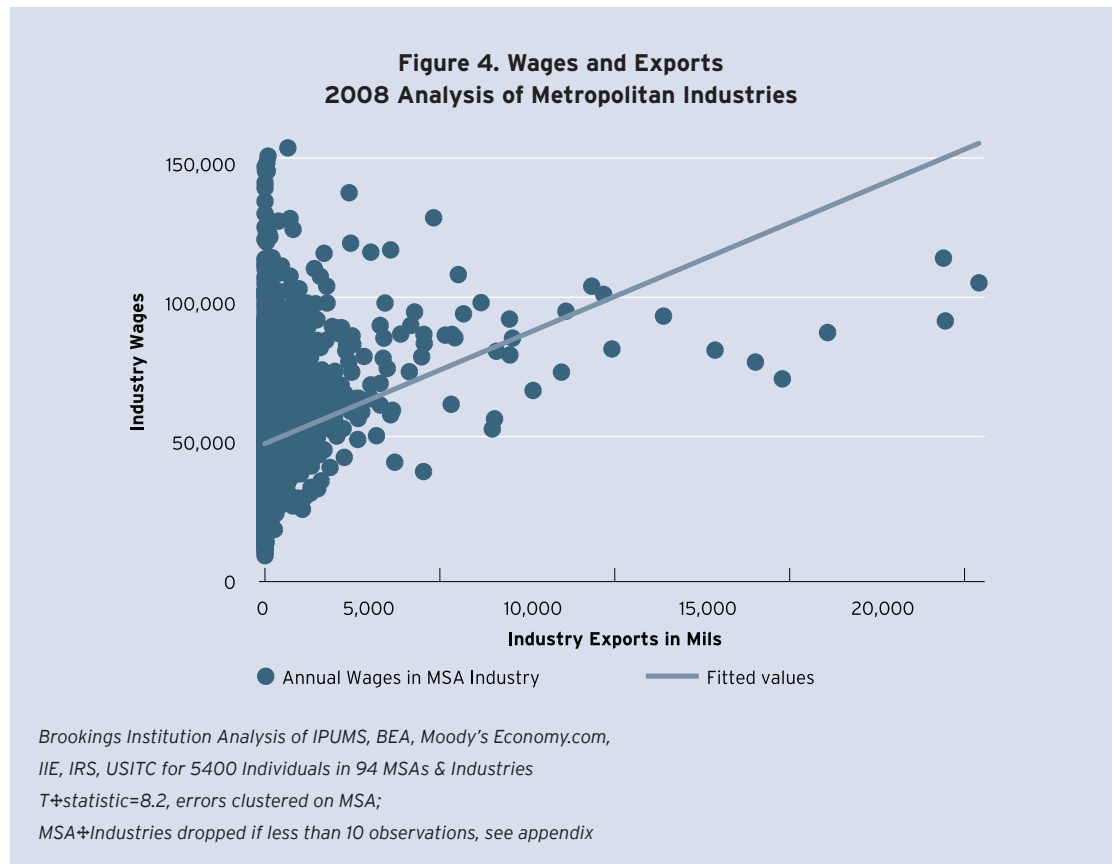
At the other end of the spectrum, Detroit lost $2.26 billion in exports from its transportation equipment industries, leading to zero net growth in exports. Large gains in petroleum and coal manufacturing, and business services like architecture, royalties, and tourism were barely enough to offset these massive losses.

High growth in exports does not simply fulfill abstract macroeconomic goals. These growth figures translate into jobs. As Figure 3 shows there is a very strong correlation between export increases and job increases, even adjusting for GMP without exports or total GMP. In fact, the relationship between export growth and job growth is much tighter than the relationship between GMP growth and job growth. This analysis does not prove that changes in exports are the primary sources of job gains, since increases in employment could also increase exports, but from the perspective of metropolitan areas, it really doesn't matter. Jobs and exports clearly go together. The bottom line is that 5,800 jobs are required for every $1 billion in 2008 exports for the average metropolitan area.

**5. Export intensive industries pay higher wages than domestic oriented industries in large metropolitan areas.** In an analysis of the 94 of the largest 100 metropolitan areas, for every $1 billion in exports of a metro area industry, workers in that industry earn roughly 1 to 2 percent higher wages.[73] Even those exporting industry workers without high school diplomas earn a higher wage. This wage effect can be seen even adjusting for worker characteristics, occupation, or the characteristics of the metropolitan area.

It is important for metropolitan areas to be aware of their exports structure and the role of their exports in the metropolitan economy. However, these descriptive characteristics do not necessarily indicate a better economic performance of a metropolitan area or more prosperity for its inhabitants. To better understand that connection, this study examines the relationship between metropolitan exports and wages (See Figure 4).

In an analysis of the 94 of the largest 100 metropolitan areas, for every $1 billion in exports of a metro area industry, workers in that industry earn roughly 1 to 2 percent higher wages.[74] For an industry with $10 billion in metropolitan exports, its workers earn 10-20 percent higher wages than

**Figure 4. Wages and Exports**
**2008 Analysis of Metropolitan Industries**

*Brookings Institution Analysis of IPUMS, BEA, Moody's Economy.com,*

*IIE, IRS, USITC for 5400 Individuals in 94 MSAs & Industries*

*T÷statistic=8.2, errors clustered on MSA;*

*MSA÷Industries dropped if less than 10 observations, see appendix*

workers in a non-exporting industry located in the same metropolitan area. This relationship is highly significant, even adjusting for individual characteristics like age, education, immigrant status, race, and gender, as well as effects associated with specific metropolitan areas, occupations and industries.

One possible explanation for this result is that more educated workers are employed by exporting industries. Yet, the analysis conducted here finds that the export premium holds even adjusting wages for average education attainment in the metro exporting industry. Moreover, even workers without high school diplomas earn the export premium. Workers who lack high school diplomas earn wages that are roughly one percent higher, on average, for every billion dollars of exports produced by their metro-industry. Hence, the explanation for the premium seems to be that working in a metro exporting industry makes workers more productive. Other studies have suggested that exporting firms are more innovative, which may explain why they can afford higher wages.[75]

Exporting industries paid considerably more than the 2008 national average wage of $45,563.[76] High paying metro industries such as pharmaceuticals in the New York metropolitan area are responsible for an estimated $20 billion in foreign sales and pay $105,213 in average wages (Table 7). Computer manufacturing in San Jose (paying $114,053), airplane manufacturing in Seattle (paying $81,004), autos in Detroit (paying $76,706), and film production in Los Angeles (paying $94,952) are among top exporting industries in the top 100 metro areas.[77] Many of these industries generate not only direct export sales, but additional proceeds from royalties on patents and trademarks, which are included in the measure of export sales.

***6. Future export growth will come increasingly from large emerging markets.*** With the rapid urbanization and growth in emerging economies, developing countries will drive the growth of the world's consumption in the future. While only 30 percent of the world's population lived in urban areas in 1950, today it's over half, and the United Nations forecasts that 70 percent of the world's population will be urbanized by 2050.[79] This urbanized population will increasingly have more purchasing power and demand more specialized goods and services.

## Table 7. The 30 Largest Metro-Industry Exports and Their Wages, 2008

| Metro Area | Exporting Industry | 2008 Metro Industry Exports in Mils | 2008 Average Annual Wages in Metro Industry |
|---|---|---|---|
| New York-Northern New Jersey-Long Island, NY-NJ-PA | Chemicals | 20,409 | 105,213 |
| Portland-Vancouver, -Beaverton, OR-WA | Computer and Electronic Products | 19,456 | 91,535 |
| San Jose -Sunnyvale-Santa Clara, CA | Computer and Electronic Products | 19,394 | 114,053 |
| Houston-Sugar Land-Baytown, TX | Chemicals | 16,082 | 87,300 |
| Los Angeles-Long Beach-Santa Ana, CA | Computer and Electronic Products | 14,797 | 70,653 |
| Detroit-Warren-Livonia, MI | Transportation Equipment | 14,020 | 76,706 |
| Seattle-Tacoma-Bellevue, WA | Transportation Equipment | 12,872 | 81,004 |
| Dallas-Fort Worth -Arlington, TX | Computer and Electronic Products | 11,397 | 93,290 |
| Los Angeles-Long Beach-Santa Ana, CA | Transportation Equipment | 9,917 | 81,445 |
| Boston-Cambridge-Quincy, MA-NH | Computer and Electronic Products | 9,689 | 101,085 |
| New York-Northern New Jersey-Long Island, NY-NJ-PA | Professional, Scientific, and Technical Services | 9,346 | 104,005 |
| Los Angeles-Long Beach-Santa Ana, CA | Motion Picture and Sound Recording Industries | 8,603 | 94,952 |
| Houston-Sugar Land-Baytown, TX | Machinery | 8,479 | 73,163 |
| San Francisco-Oakland-Fremont, CA | Petroleum and Coal Products | 8,101 | 148,481* |
| Chicago-Naperville-Joliet, IL-IN-WI | Machinery | 7,668 | 66,513 |
| Phoenix-Mesa-Scottsdale, AZ | Computer and Electronic Products | 7,082 | 85,395 |
| Chicago-Naperville-Joliet, IL-IN-WI | Chemicals | 6,999 | 79,350 |
| Austin-Round Rock, TX | Computer and Electronic Products | 6,990 | 92,223 |
| Dallas-Fort Worth-Arlington, TX | Transportation Equipment | 6,618 | 80,622 |
| Dallas-Fort Worth-Arlington, TX | Chemicals | 6,559 | 56,299 |
| Los Angeles-Long Beach-Santa Ana, CA | Chemicals | 6,502 | 52,670 |
| Houston -Sugar Land-Baytown, TX | Petroleum and Coal Products | 6,178 | 98,121 |
| Philadelphia-Camden-Wilmington, PA-NJ-DE-MD | Chemicals | 5,679 | 94,073 |
| Washington-Arlington-Alexandria, DC-VA-MD-WV | Professional, Scientific, and Technical Services | 5,533 | 108,101 |
| Indianapolis-Carmel, IN | Chemicals | 5,437 | 85,415 |
| Los Angeles-Long Beach-Santa Ana, CA | Professional, Scientific, and Technical Services | 5,345 | 86,683 |
| Wichita, KS | Transportation Equipment | 5,322 | 61,563 |
| New Orleans-Metairie-Kenner, LA | Petroleum and Coal Products | 5,157 | 86,389 |
| San Francisco-Oakland-Fremont, CA | Computer and Electronic Products | 4,824 | 128,540 |

*Note: Royalties exports were added to the exports of the industry that created the intellectual property right. Wages were calculated from the Census Bureau's 2008 American Community Survey, provided by IPUMS.[78]*

*\* The source for the average wages in the San Francisco-Oakland- Fremont, CA, petroleum and coal products industry is BLS, Quarterly Census of Employment and Wages (QCEW).*

*Source: Brookings analysis of Moody's Economy.com, U.S.ITC, BEA, IRS, and IIE data*

Brazil, India, and China (the BIC countries) will play a major role in this trend.[80] Based on the International Monetary Fund estimates, the BIC countries combined will be more than a quarter of the world economy by 2015, a rapid increase from the 19 percent share in 2008.[81] Further, according to a recent Brookings study, the BIC countries, which accounted for 8.4 percent of the global middle class consumption in 2009, could reach 26 percent by 2020, conditional on continuous policy adjustment and structural transformation.[82] The United States has not fully taken advantage of this emerging wave. The U.S. exports to the BICs were only 8.8 percent of U.S. sales abroad in 2008. However, they have been growing rapidly over the last five years and proved resilient during the recent crisis.

The United States sold $142 billion worth of goods and services to the BIC countries in 2008. U.S. exports to the BICs more than doubled in real terms over the 2003–2008 period, with exports to China

**Table 8. Top 10 U.S. Exports to the BIC countries, 2008**

| Rank | Export Category | 2008 (blns USD) | Share out of U.S. Exports to BICs |
|------|-----------------|-----------------|-----------------------------------|
| 1 | Chemicals | 20.5 | 14.4% |
| 2 | Transportation Equipment | 17.2 | 12.1% |
| 3 | Computer and Electronic Products | 16.1 | 11.3% |
| 4 | Machinery | 13.4 | 9.4% |
| 5 | Agriculture | 10.2 | 7.2% |
| 6 | Travel and Tourism | 8.7 | 6.2% |
| 7 | Business Services | 6.6 | 4.7% |
| 8 | Education | 5.2 | 3.7% |
| 9 | Royalties from Intellectual Property | 5.1 | 3.6% |
| 10 | Freight and Port Services | 4.9 | 3.5% |
| | **Top 10 U.S. Exports to BICs** | **107.8** | **75.9%** |
| | **U.S. Exports** | **142** | **100.0%** |

*Source: Based on BEA 2010, USITC 2010*

almost half that growth. Given that they have been growing at a much faster rate than U.S. exports elsewhere, the BIC countries have been gaining share as U.S. export markets—from 5.9 percent to 9.6 percent of U.S. exports between 2003 and 2009. U.S. exports dropped almost 11 percent in 2009, but the exports to the BICs declined by only 2.8 percent. Growing U.S. exports to China in 2009 counterbalanced the 9.7 percent drop in sales to Brazil and 6.7 percent decline in sales to India.

The composition of the U.S. exports to the BICs changed between 2003 and 2008. About three quarters of U.S. exports to these countries are merchandise, mainly manufactured goods, and a quarter is services. In 2003 the largest U.S. exports to the BICs were in the computer and electronics category, but by 2008 chemicals and transportation equipment were dominant. As a result, 12.4 percent of U.S. exports of chemical products are going to the BIC markets. U.S. services sales have also expanded. For example, U.S. sales of business and professional services to BIC customers, such as consulting, architecture, and legal services, more than doubled during the same time period.

Computers and electronics hold the top spot for U.S. exports to China. Eight percent of U.S. computer and electronics sales in 2008 went to the Chinese market. Chemicals were the largest U.S. export to both Brazil and India, with transportation equipment being in second place. All three exports increased significantly between 2003 and 2008. U.S. exports of chemicals almost doubled, computer and electronics more than doubled and transportation equipment sales to the BICs almost tripled in the five year period. The metropolitan areas that produce these goods are well-positioned to take advantage of the growth of the BIC countries.

The nation's large Western metropolitan areas are the largest computer producers and exporters of computer and electronics equipment to China. Six out of the top 10 metropolitan areas that are major exporters of computers to China are located in California, Oregon, Washington and Arizona (Table 9). Texas' large metro areas, Dallas, Austin, and Houston also figure prominently among the major U.S. computer and electronics sellers to China. Boston is the only Northeastern large metro that is a large exporter of the No 1 U.S. sale category to China.

## Table 9. Top Metros Exporting of Computer and Electronics Equipment to China

| Metro Area | Computer and Electronics exports to China, 2008 (mil $) | Share out of U.S. computer exports to China |
|---|---|---|
| Portland-Vancouver-Beaverton, OR-WA | 1,015 | 9.2% |
| San Jose-Sunnyvale-Santa Clara, CA | 1,014 | 9.2% |
| Los Angeles-Long Beach-Santa Ana, CA | 769 | 6.9% |
| Dallas-Fort Worth-Arlington, TX | 594 | 5.4% |
| Boston-Cambridge-Quincy, MA-NH | 505 | 4.6% |
| Phoenix-Mesa-Scottsdale, AZ | 371 | 3.3% |
| Austin-Round Rock, TX | 364 | 3.3% |
| San Francisco-Oakland-Fremont, CA | 251 | 2.3% |
| Houston-Sugar Land-Baytown, TX | 237 | 2.1% |
| San Diego-Carlsbad-San Marcos, CA | 222 | 2.0% |
| Top 10 total | 5,343 | 48.2% |
| **Largest 100 metro areas** | **8,386** | **75.7%** |
| **United States** | **11,074** | |

*Source: Brookings analysis of Moody's Economy.com, U.S.ITC, BEA, IRS, and IIE data*

The large metropolitan areas that are producers and exporters of chemicals are scattered across the country. The Northeastern metros of New York, Philadelphia, and Boston produced 15 percent of U.S. exports of chemicals to India in 2008 (Table 10). Houston and Dallas followed suit with 12 percent. Some smaller metro areas, such as Baton Rouge, are also among the metropolitan areas that are major producers of chemicals and exporters to India.

## Table 10. Top 10 Metropolitan Exporters of Chemicals to India, 2008

| Metro Area | Chemicals exports to India, 2008 (mil $) | Share out of U.S. chemical exports to India |
|---|---|---|
| New York-Northern New Jersey-Long Island, NY-NJ-PA | 522.1 | 10.8% |
| Houston-Sugar Land-Baytown, TX | 410.1 | 8.5% |
| Chicago-Naperville-Joliet, IL-IN-WI | 178.5 | 3.7% |
| Dallas-Fort Worth-Arlington, TX | 167.3 | 3.5% |
| Los Angeles-Long Beach-Santa Ana, CA | 166.1 | 3.4% |
| Philadelphia-Camden-Wilmington, PA-NJ-DE-MD | 144.5 | 3.0% |
| Indianapolis-Carmel, IN | 138.6 | 2.9% |
| San Francisco-Oakland-Fremont, CA | 92.1 | 1.9% |
| Baton Rouge, LA | 87.0 | 1.8% |
| Boston-Cambridge-Quincy, MA-NH | 62.8 | 1.3% |
| Top 10 total | 1,969.1 | 40.9% |
| **Largest 100 metro areas** | **3,284.5** | **68.2%** |
| **United States** | **4,815.0** | |

*Source: Brookings analysis of Moody's Economy.com, U.S.ITC, BEA, IRS, and IIE data*

**Table 11. Top 10 Metropolitan Exporters of Transportation Equipment to Brazil, 2008**

| Metro Area | Transportation equipment exports to Brazil, 2008 (mil) | Share out of U.S. transportation exports to Brazil |
|---|---|---|
| Detroit-Warren-Livonia, MI | 437.0 | 6.3% |
| Seattle-Tacoma-Bellevue, WA | 401.2 | 5.8% |
| Los Angeles-Long Beach-Santa Ana, CA | 308.9 | 4.5% |
| Dallas-Fort Worth-Arlington, TX | 206.4 | 3.0% |
| Wichita, KS | 165.7 | 2.4% |
| Hartford-West Hartford-East Hartford, CT | 139.8 | 2.0% |
| Phoenix-Mesa-Scottsdale, AZ | 109.1 | 1.6% |
| Boston-Cambridge-Quincy, MA-NH | 102.6 | 1.5% |
| Cincinnati-Middletown, OH-KY-IN | 94.7 | 1.4% |
| St. Louis, MO-IL | 94.3 | 1.4% |
| Top 10 total | 2,059.7 | 29.9% |
| **Largest 100 metro areas** | **4,168.9** | **60.5%** |
| **United States** | **6,886.0** | |

*Source: Brookings analysis of Moody's Economy.com, U.S.ITC, BEA, IRS, and IIE data*

The Midwestern large metropolitan areas were still the largest U.S. producers of transportation equipment in 2008 and they delivered almost a fifth of the U.S. exports of transportation equipment to Brazil. Detroit, Wichita, Hartford, and Cincinnati produced 12.2 percent of U.S. exports of transportation equipment to Brazil (Table 11). Western metro areas, such as Seattle, Los Angeles, and Phoenix are also major producers and exporters of transportation equipment.

## IV. Policy Implications

In the aftermath of the recession, a U.S. economy searching for demand growth should look to become more export oriented and less dependent on domestic consumption. Exports could deliver good paying jobs, especially at a premium now, due to the so far jobless recovery and continuing wage disparities. An increase in exports relative to imports also could help reduce U.S. dependence on foreign borrowing and the chance of massive investment bubbles.

The focus of U.S. export policy to date has been on trade and export promotion. Trade barriers, either tariffs, quotas, or more subtle technical barriers distort the incentives to trade. In this regard, the negotiation and enforcement of trade agreements are an essential factor in increasing exports. Further, government provision of foreign markets research and export financing helps U.S. firms, especially small and medium sized businesses, overcome the risks inherent in doing business in foreign countries.

Though key components of U.S. export strategy, trade and export promotion will not by themselves deliver the goal of doubling exports. Increasing exports requires a broader export strategy that moves beyond the conventional discourse about trade and export promotion. Firms that are willing to take risks in the production and export of new goods and services could be helped with a consistent innovation and clusters policy, and deliberate and focused freight strategies, all implemented in an evidence-driven manner. The advantage of including these policy areas in the export strategy is two-fold: it reduces the cost of production of U.S. exporting firms while at the same time it promotes the creation of jobs and value added in the United States.

To realize the U.S. export potential, America must connect the macro vision of a more export oriented economy to its metropolitan reality. This requires the export strategy to follow a new type of federalism, focused on metropolitan areas and economic competitiveness.[83] Each responsibility should

be handled at the lowest possible effective level.[84]

"Dividing the job" is not a new idea.[85] Given the findings of this report, three main policy goals and areas of improvement emerge: leveling the playing field on trade and currency, improving U.S.-made products for export, and connecting those products to global markets.

## A. Leveling the Playing Field on Trade and Currency
The federal government is the only entity able to carry out currency and trade policies. In its efforts to double exports, the U.S. government should more actively pursue negotiations around exchange rates and trade liberalization.

The previous surge periods of U.S. exports show that the exchange rate of the dollar is an important variable in this process, but not the only one. Setting policy effects aside, the rapid increase of U.S. exports during 1987-1992 was caused mainly by the dollar's depreciation and the relatively stronger growth in America's export markets.[86] With the dollar estimated to be overvalued currently, there is plenty of room for the dollar to depreciate.[87] A fair market exchange rate of the dollar with the main U.S. trading partners' currencies could contribute to the expansion of U.S. exports.[88] Given the benefits to all the parties involved in trade, bilateral and multilateral discussions should move forward, and the United States should advocate appropriate changes to international trade law to address exchange rates.[89]

The U.S. government should push for better access to more sectors especially in export markets that are growing rapidly. For example, while the United States economy is projected to grow by 2.9 percent in 2011, the emerging economies in Asia are estimated to grow at 8.5 percent next year.[90] The focus should be on industries in which the United States is competitive internationally and could capture a niche market. However, mere access is not sufficient; U.S. companies have to be assured that their intellectual property rights are protected in these countries.

Over the medium term, the federal government should push to open new markets to U.S. companies. While the existing export markets will be the source of any export growth over a five year horizon, new markets are essential for export growth over a longer time frame. For example, between 1993 and 2003, U.S. firms that accessed new markets or sold new products comprised 42 percent of the export growth.[91]

More bilateral trade agreements and especially multilateral trade agreements will deliver new foreign demand for U.S. goods and services. Besides moving the Doha agenda forward, more attention should be paid to the other free trade agreements (FTAs). There is evidence that FTAs boost overall trade, which despite harming some U.S. businesses and their workers (who should be compensated for their loss) tends to enrich the country.[92] As to exports in particular, FTAs do not guarantee that exports will increase relative to imports, but most American FTAs did result in an improvement in the trade balance in goods.[93]

The United States has been slow in reaching free trade deals with the rapidly growing Asian countries. For example, while the United States is at the beginning of negotiations to join the Trans-Pacific Partnership, the European Union is on its last leg of negotiations with India on a free trade agreement and China has a new free trade area with the Association of South-East Asian Nations (ASEAN) starting this year.[94] This new China-ASEAN free trade area is the largest free trade in the world, with a market of 1.9 billion people.

## B. Improving U.S. Made Products for Export
In an increasingly competitive world, where developing countries are moving up the value chain, it is essential for the United States to maintain the pace of innovation to improve and perfect products and processes. However, new technologies, products, and business models present larger benefits than innovators and entrepreneurs can capture, resulting in private under-investment in R&D.[95] While the federal government funds basic research, this R&D activity is spread across the country, often failing to reach the critical size for fueling economic clusters.[96] Moreover, private innovation efforts, as expressed by R&D services, are increasingly divorced from manufacturing locations.[97]

First and foremost, the federal government should follow through on the promise of increasing funding for R&D up to 3 percent of GDP.[98] Given that manufactured goods are still a major part of U.S. exports, support for technology modernization efforts in manufacturing would help in growing

U.S. exports.[99] Modeled on successful efforts in Korea and Finland, the United States should create a National Innovation Foundation, for better coordination of the government's fragmented efforts to boost commercialization of innovations in fields such as precision manufacturing, information technology, and clean energy.[100] Both the firms exporting high value added goods and services and their metro locations would benefit from increased federal and state support for cluster development that clearly connects R&D and human capital policies to process-innovation and co-location.[101]

The federal government should enhance the nascent regional innovation cluster initiatives. These competitive programs allow states and metro areas to strengthen their critical regional innovation networks and clusters. The Economic Development Administration (EDA) created a regional innovation cluster program in 2009 and the administration announced in February this year a multi-agency energy regional innovation cluster (E-RIC).[102] The E-RIC program emphasizes collaboration between agencies and the private sector focused on filling the gap between scientific discovery and commercialized knowledge in a localized manner.[103] These regional innovation hubs would provide a clear impetus for more co-location of high technology services and manufacturing.[104]

Metro areas can also help their companies move up the value chain by strengthening their existing centers of innovation, in public and private research institutions, and fostering emergent, high-potential clusters. Moreover, they could partner with or otherwise support private sector and non-profit sector organizations that provide cluster support services, such as industry-specific training, market intelligence, and loans.[105] They could also encourage existing clusters to create an export strategy as part of their development plan.

After identifying their exporting industries, metro areas could better cater to their workforce needs. Becoming more competitive does not mean necessarily a college education, but it does require more than a high school diploma. Local community colleges and post-secondary technical schools will deliver the bulk of the next American workforce.[106] Providing this ecosystem, metro areas incentivize companies to co-locate their research and development services with manufacturing, basically anchoring the firms in the region.[107]

As a fundamental foundation, leaders at every level should undergird the efforts on clusters and innovation with renewed commitment to science, technology, engineering, and mathematics (STEM) education.

## C. Connecting U.S. Products to Global Markets

### National Export Promotion

The National Export Initiative (NEI), launched in March 2010, is the latest federal policy to promote U.S. exports.[108] This export promotion policy is focused on increased trade financing, advocacy, and assistance for American businesses, especially small and medium sized businesses interested in expanding their markets abroad.

It is difficult to evaluate the effectiveness of export promotion activities, due to numerous factors that impact the export volumes of firms.[109] However, a World Bank review of 103 countries shows that export promotion agencies have a significant impact on the volume of exports, on average.[110] The study also found out that a single export promotion agency, small but with well-defined responsibilities works better than a number of agencies involved in the export promotion effort. The private sector should be heavily involved in the strategy of this agency, but the government would provide the bulk of funding. The agency should focus on broad sectors, such as manufacturing, agriculture, and high- tech. Beyond the regular targeting of small and medium sized businesses, the agency should pay attention to large firms that are not exporting yet.

The NEI proposes a decentralized network of initiatives across federal agencies and not a single export promotion agency. This follows the model already in place with the Trade Promotion Coordinating Committee (TPCC) as the main facilitator, as described above. According to GAO, while TPCC has improved in its performance, it lacks a review of how the agencies involved in export promotion allocate budgets relative to government-wide export promotion priorities.[111]

To better connect U.S. products to global markets, the following changes should be considered:
- Federal export financing should be more targeted, to get more efficiency out of federal funding, reducing their costs upstream.[112]

- The federal agencies involved in NEI should have a clear coordination process, with trans-parent distribution of funding and responsibilities for export promotion.[113]
- The federal government needs to become more federalist in thinking and action and engage more aggressively the private sector in the export strategy.
- States and metropolitan leaders should be part of the President's Export Council.[114]
- NEI should be an interactive and educational forum for all the actors involved, be it govern-ment or private sector.

Finally, the federal government should integrate the different pieces of the broader export strategy. Extending the NEI beyond the traditional trade, currency, and export promotion requires a mechanism connecting these policies and the domestic areas of innovation, freight, and data collection. The fact is that U.S. exporting companies benefit when federal agencies leverage each other's sources to help U.S. exports. Suniva, a photovoltaic cells manufacturing company located in Atlanta, is an example of a successful U.S. exporter benefiting from targeted government aid (See Sidebar).[115]

### Metropolitan Export Initiatives

Additionally, metropolitan areas should develop their own initiative to boost metro exports, which must be evidence driven, cluster led, and metropolitan in scope and scale.[116] Ideally, these initiatives should be organized and even implemented by business groups with support from other sectors—civic, government, labor, and university—that are critical to success. Metro leaders need to understand that the well- being of their constituencies will depend increasingly on how much their businesses sell abroad, where the demand resides. While some metropolitan areas are aware of their exports (the metros in the Bay Area and Seattle), most metro areas, large or small, do not pay particular attention to foreign demand (See Sidebar).[117] A metropolitan export initiative should complement efforts to identify and strengthen metropolitan industry clusters. Most of the metro exports are generated by metro export clusters and metro leaders should build on their export clusters through a broad array of policies: collective marketing efforts to nurture distinctive regional brands, tailored assistance to their exporters, capital vehicles that are tailored to different stages of development, workforce training, and freight prioritization. Examples from abroad could help metro leaders in their plans (See sidebar).

Metropolitan areas should collaborate with the state and federal export promotion offices for more or tailored assistance for their exporters. Ex-Im Bank has already a city/state partners program that helps businesses learn about the credit enhancement products available to jump-start export activities. Metropolitan areas, such as Los Angeles and New York have been part of the network since 2007 through the Los Angeles Area Chamber of Commerce and the Brooklyn International Trade Development Center.

Metro areas should learn how to use most effectively federal and state services and not dupli-cate them (Map 3). While some metro areas such as those in the Bay Area can afford an office abroad, most metro areas could take advantage of the federal Export Assistance Centers (within Commerce's International Trade Administration (ITA)) at home and abroad to organize trade missions under a metro brand.

For example, the newly created Economic Development Administration/International Trade Administration Job Creation Mission helps U.S. communities generate jobs by connecting the metropolitan areas with opportunities offered by the global marketplace. In April 2010, the first mission to Hannover, Germany had 16 U.S. economic development organizations, half of which represented auto communities.

A metropolitan export initiative should be sector agnostic and concentrate on the strengths of a metropolitan area. Moreover, in a similar fashion with the national export strategy, an export strategy at the metro level should go beyond export assistance services. Metro areas should leverage the innovation, human capital, freight, and data collection policies to fuel their exports. These policies allow the development of the export capability of a metro area: large companies, small and medium enterprises, research institutions, infrastructure, specialized services, skills providers and business associations.

### Suniva–An American Success Story

Suniva, Inc. manufactures high-efficiency silicon solar cells and high power solar modules. The company was created in 2007 by Dr. Ajeet Rohatgi, an Indian born scientist educated in the United States. The firm is based on his work at the Georgia Institute of Technology's University Center of Excellence in Photovoltaics (UCEP), a Department of Energy Center of Excellence.

The company located in the Atlanta metro area has been growing rapidly, with nearly $1 billion in orders from Indian and European solar module makers between 2007 and 2009. Ninety percent of Suniva's sales in 2009 were exports and it is expected to export well over 100 million dollars in 2010. More than 85 percent of the content of its products is U.S.-made.

In 2009 Suniva was already considering a second plant. The company was selected for consideration of a $141 million loan guarantee from the U.S. Department of Energy Loan Guarantee Program in April 2010. If successful, Suniva will use this loan guarantee towards the construction of a new plant in the Saginaw metro area in Michigan.

Suniva has 160 employees and is planning to hire 500 additional staff at the future plant in Michigan. The Michigan Economic Development Corporation estimates this investment would generate 2,000 indirect jobs for the Michigan economy. In addition, the loan guarantee would enable Suniva to quadruple exports over the next five years, according to Bryan Ashley, the Chief Marketing Officer at Suniva.

Suniva used also the services of Ex-Im Bank to expand in India. It got the Ex-Im Bank's short-term multibuyer insurance policy to offer a $500,000 credit line to a customer in India. This credit line has led to several customers applying for Ex-Im Bank loans.

The company won the 2010 Renewable Energy Exporter of the Year from Ex-Im Bank and ranked second in *The Wall Street Journal's* Top 10 Venture-Backed Clean Technology Companies in 2010. ■

### Freight Policy

Seaports and airports located in metro areas are important for the U.S. exports. Two thirds of the U.S. exports are merchandise and three quarters of the goods export tonnage is shipped abroad through ports. In addition, goods exports carried by commercial airplanes make up more than a third of the U.S. goods exports value.[118] Large metropolitan areas are essential to the export flows. Seventy percent of U.S. goods exports were shipped from freight gateways located in 40 large metropolitan areas in 2008.[119] A bottleneck in these ports would have ripple effects across the country.

In collaboration with the states and metropolitan areas, the federal government should develop a comprehensive National Freight Transportation Plan as a framework for goods movement policy and investment that spans all modes.[120] This process should build off of the FHWA's Freight Performance Measures Initiative and prioritize corridors on a cost-benefit analysis that would include all modal options.[121] Learning from Germany, the United States should create a finance and evaluation mechanism to support its major seaports and airports to remain globally competitive.[122] Funding mechanisms such as the Transportation Investment Generating Economic Recovery (TIGER) grants and the Transportation Infrastructure Finance and Innovation Act (TIFIA) program could help, but they would be insufficient. A National Infrastructure Bank, focused on projects of national significance, would be a more appropriate federal financing vehicle for major freight improvements.[123] Last but not least, more public–private partnerships in financing the modernization of the nation's ports and airports would leverage the federal funding.

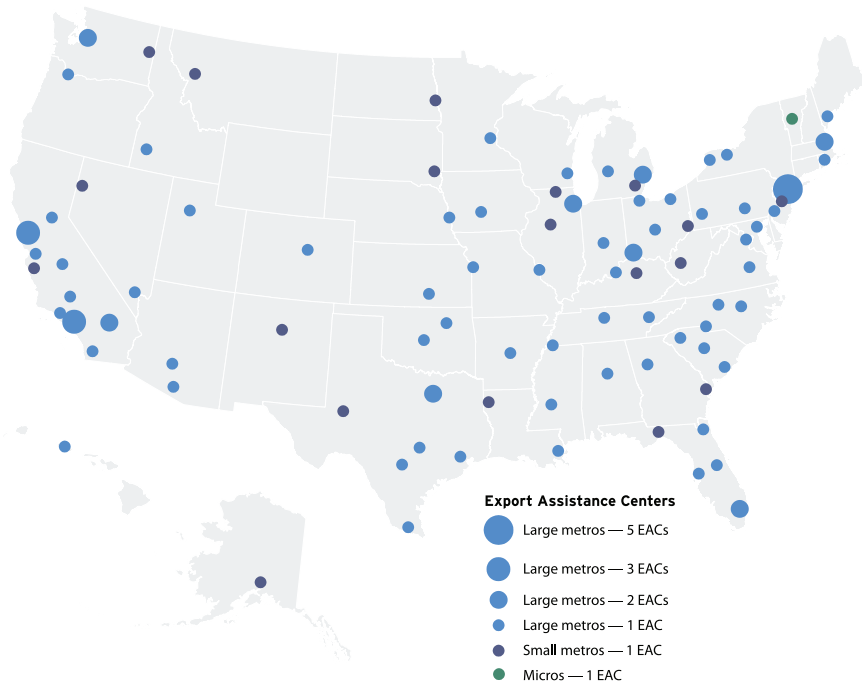### Improve Market Information and Maximize Performance

Overarching these efforts should be evidence driven and performance measured policies that would allow for better management and course correction of export strategy. This would require all levels of government to improve their data collection on export trends, export capabilities, and export promotion activities. These metrics are necessary for any measurement of success of the policies implemented, an issue inherently difficult due to the convoluted relationship between export promotion and export volumes.[124]

Federal export statistics suffer from a number of problems that limit export analyses. In order to identify the location of production of U.S. exports, it would be helpful for the current systems of data collection to require identification of the county of the producer of the good or service exported. It would be helpful for Census to create a master concordance between services exports categories and NAICS codes, as it has done for goods. This would allow a link between service export figures and their producers' characteristics. The federal government needs also to collect better data on the export promotion activities. As the GAO found out, the Commercial Service within the ITA, the main federal body in charge of export promotion of nonagricultural products, does not have reliable and sufficient data on its customer base.[125]

Support for the U.S. Census and Bureau of Economic Analysis to collect more geographically detailed data would help. Ultimately, most metropolitan areas, in partnership with the local Chambers of Commerce, could collect the export data on their own with the help of a survey. The focus should be on exports that companies produce in a certain metro area and on the destination markets of these exports. Service exporters should be also included in the survey, given the rising importance of service exports in metropolitan areas and the United States, as a whole.

**Map 3. Federal Export Assistance Centers, United States, 2010**



**Export Assistance Centers**
- Large metros — 5 EACs
- Large metros — 3 EACs
- Large metros — 2 EACs
- Large metros — 1 EAC
- Small metros — 1 EAC
- Micros — 1 EAC

*Data source: U.S. Commercial Service, ITA, 2010.*

## V. Conclusion

In the aftermath of the recession, increasing U.S. exports could contribute significantly to the reduction of the current job deficit, and the largest 100 metropolitan areas are central to this potential

Exports deliver good paying jobs. U.S. exports supported 11.8 million jobs nationally and 7.7 million jobs in the top 100 metro areas in 2008. The export related jobs pay better than metropolitan jobs in other industries. For every $1 billion dollar increase in the exports of the industry in which they work, workers in the exporting industries located in 94 of the top 100 metro areas earn roughly one to two percent higher wages. Even workers without high school diplomas earn an export premium, if they work in an export industry.

To build its next economy, the United States needs to connect the macroeconomic goal of increasing exports with the metropolitan reality. Any export promotion strategy should follow a metro-centric federalist perspective and be a true public-private partnership to be effective. While the federal government should lead in trade and currency policies, together with the states, it should empower metropolitan areas on export promotion, innovation, freight, and data collection policies. Metropolitan leaders should innovate to increase their export capabilities and modernize their economic development strategy from 20th century thinking to 21st century action on export-oriented economic growth. Ultimately, all U.S. metropolitan areas, large or small, must export more. Public and private sector leaders have to overcome their export paralysis and get engaged actively in the export game to create good paying jobs at home.

## APPENDIX A

### HOW THE EXPORT DATA WAS PRODUCED

The purpose of this study is to examine the U.S. exports produced in the top 100 metropolitan areas. While the Census Bureau (Census) and the International Trade Administration (ITA) have been compiling metropolitan goods exports since 1995, these data do not accurately reflect the origin of production. They are allocated based on origin of movement declared by the exporter, which is not always the place where the good was produced. In addition, if the exported goods are consolidated, the metro export series assigns them to the metro area where the consolidation point is located.[129] Last but not least, the Census- ITA metro exports data are limited only to merchandise trade, not including services flows.

This study allocates U.S. domestic exports associated with an individual industry in proportion to each metropolitan area's Gross Metropolitan Product (GMP) share generated by the same industry in the United States. This assumes if Wichita, KS produces 20 percent of the national value added of transportation manufacturing, then this metro area also exports 20 percent of the U.S. transportation equipment. In the case of trading partners, this report apportions the U.S. exports associated with an industry sold to a particular country to each of the 100 largest metro areas in proportion with the metro share of output produced by that same industry to the national total.

Our methodology uses output instead of employment to allocate the national exports to the metro level, because the GMP reflects better the value added by the exported goods and services.[130] The difference is more at the conceptual level- there is a very high level of overlap between the export estimates based on employment and on output.[131]

In an effort to better approximate metropolitan services exports, this study employs a different allocation method for three service categories. Those three are royalties from intellectual property, travel and tourism, and education.

First, for royalties, this study introduces an additional step in the allocation method. This study first calculates an industry's specific royalties acrrued from the use of U.S. patents and trademarks by foreigners by multiplying the U.S. royalties export revenue with the share of the industry's royalties out of the total U.S. royalties. We allocate this industry's royalties exports to the metropolitan level in proportion to each metropolitan area's Gross Metropolitan Product (GMP) share generated by the same industry in the United States.[132]

A similar allocation method was used for the travel and tourism exports, by estimating first the export revenues that accrue to an industry that sells goods and services consumed by foreign tourists. U.S. travel exports were multiplied by the share of a tourism-related industry's sales out of the total U.S. tourism and travel sales. Then this industry's travel and tourism exports were allocated to metropolitan areas in proportion to each metropolitan area's share of value added in the same industry.

Finally, in the case of education, this study uses the metropolitan share of the number of foreign students out of the total number of foreign students in the United States to allocate national education exports to metropolitan areas. This data was obtained from the Institute for International Education.

The method uses here is similar to previous efforts to estimate sub-national export data based on location of production. Testa, Klier and Zelenev from the Federal Reserve Bank of Chicago employed a similar method, using metropolitan industry employment shares.[133] Brooks, with the U.S. Department of Agriculture, used the state level agricultural production data to allocate U.S. exports of agricultural goods to the States of production.[134] In addition, the Bureau of Economic Analysis (BEA) uses an allocation method to estimate the Gross Metropolitan Product from the state output.[135]

### *Accuracy of the Estimates and a Comparison to the ITA's Metropolitan Exports Series*

Comparing the Brookings exports estimates to the ITA data confirms that the Brookings estimates are much more accurate. In general, they are highly correlated, but there are some significant differences. According to the ITA metropolitan exports series, there are 15 metropolitan areas out of the 100 largest that exported a larger value of goods than they produced in goods. Export sales for an individual company could theoretically be higher than the gross value added by that company because value added does not include the value of intermediate inputs produced elsewhere but embodied in the product. For an entire metropolitan area, however, it is not credible that export sales could be worth

more than value added, especially given the low intensity of exports in the United States. The highest ratio in the Brookings data was a more reasonable 84 percent.

Using multi-variable regression analysis, the sources of the discrepancies between ITA and Brookings estimates were analyzed. The metropolitan areas with the highest export to GMP ratios in the ITA were in states that bordered Mexico or Canada; metros in these bordering states were allocated an average of 54 extra percentage points to their exports to GMP ratio; this represented an extra seven billion dollars in exports, most of which is probably erroneous if interpreted as the origin of production. Likewise, metropolitan areas with ports were allocated an extra 3.5 billion in exports on average.

The Brookings estimates of exports, on the other hand, are not significantly higher for metropolitan areas in states that border Mexico or Canada, and they are no higher in ports. Furthermore, the Brookings goods exports data are strongly correlated with manufacturing employment, but the ITA data have no significant correlation with manufacturing. Given that outsized importance of manufacturing to exports, this result also favors using the Brookings data over the ITA data.[136] One variable that was significantly related to exports in goods using the Brookings data was employment in road transportation. This is makes sense since manufacturing centers need to employ trucking and logistics companies to move their goods out to ports and over borders.

To illustrate the ITA bias in more detail, the metropolitan area of McAllen-Edinburg-Mission TX, which borders Mexico, exported $4.6 billion worth of goods in 2008 according to the ITA, which was 225 percent what the BEA reported that it produced in goods that year. The Brookings estimation, based on the location of production of exports, yields a more credible goods export estimate of $0.5 billion for McAllen, or 23 percent of what the metro produced.

More generally, the Brookings estimates capture the reality that metros that export a larger share of their goods outside of the metro are likely to export a larger share of their goods to other countries. The Commodity Flows Survey from the Department of Transportation allows one to calculate the share of goods that are sent outside the metro for 59 of the 100 largest metropolitan areas for the year 2007. This export orientation measure is positively and significantly correlated with the Brookings export orientation measure, but it is negatively correlated with the ITA measure. In other words, the ITA data has no statistical association with an alternative measure of exports, while the Brookings data does. Based on the above, this study concludes that the ITA data does not measure the origin of export production nearly as well as the Brookings data.

## HOW THE EXPORT JOBS DATA WAS PRODUCED

The employment estimates required three data points for each metropolitan export industry. First, this study obtained gross-value added (GMP) and employment data for each export industry in the metropolitan areas. This research then combined this data with the metropolitan exports series. The next step was to multiply industry employment by the ratio of metropolitan export sales to metropolitan GMP for each industry. This method allows for industry and metropolitan specific differences in worker productivity, but it is limited by the fact that each industry has the same ratio of exports to GMP, regardless of the metropolitan area, with the exception of education services, royalties, and tourism, because of the unique approaches used to calculate those categories.

### Box 1. Comparison of Brookings Goods Industry Exports vs. ITA Exports for McAllen-Edinburg-Mission TX MSA for 2008

|  | Brookings | ITA |
| --- | --- | --- |
| Estimated Goods Exports in $Mils | 473 | 4,578 |
| GMP for Goods Industries in $Mils (Source BEA) | 2,037 | 2,037 |
| Exports in Goods/GMP from Goods | 0.23 | 2.25 |

For 2008, export productivity, defined as the amount of exports required to support one job, was found to be $134,857. This figure is within the range—$125,000 to $166,000 exports per job—reported by Fred Bergsten of the Peterson Institute during Congressional testimony.[137]

## DATA SOURCES

This study uses data from Moody's Economy.com, the United States International Trade Commission (USITC), the Bureau of Economic Analysis (BEA), the Bureau of Labor Statistics (BLS), the Internal Revenue Service (IRS), and the Institute of International Education (IIE) to examine the export trends in the nation's 100 largest metropolitan areas.

This study employs Gross Metropolitan Product (GMP) estimates from Moody's Economy.com to compile the metropolitan share of the output produced by a certain industry out of the national total. While the BEA GMP data are of high quality and publicly available, the Moody's Economy.com fills in the suppressed industry data from BEA.[138]

The USITC provides domestic goods exports by U.S. industries, as expressed by the North American Industry Classification System (NAICS).[139] BEA provides services exports by specific categories, compiled from a number of surveys targeted at certain service industries.[140] In order to allocate services exports by production, this study constructs a match-up table between the BEA services export categories to the NAICS codes.[141] The U.S. exports in this report are a sum of USITC goods domestic exports and BEA private services exports.[142]

This study uses the Institute for International Education data to measure the number of foreign students in each metropolitan area and then used it to allocate national education exports to metropolitan areas.[143]

For the travel and tourism related industries, this study used the travel and tourism satellite account from BEA to allocate travel exports first to industries (NAICS) and then to metropolitan areas based on their production of GMP in the given NAICS.

To measure royalties exports, this study used IRS industry receipts from royalties for 2007 to allocate U.S. royalties exports to industries and then to MSAs.[144]

To adjust for inflation from 2003 to 2008, the analysis uses the Bureau of Labor Statistics Producer Price Indexes for each of the 3-digit NAICS industries that export goods. This index was available for all goods except agricultural production. These indexes were not available in sufficient detail for services, so this study used the Bureau of Economic Analysis service export price indexes to adjust service export prices by service export category. The BEA exports index for agricultural goods was also used to adjust agricultural export prices. In both cases, 2003 export values were re-valued in 2008 prices before calculating the growth rate.

This paper analyzes exports of domestic goods by 26 major industries (at 3 digit NAICS level) and commercial services exports by 26 export categories (using BEA survey categories).[145] Given this study's focus on production, this study excluded goods exports such as re-exports, waste and scrap, second-hand merchandise, goods returned to Canada, special provisions, and services exports such as government services exports, military transfers, and expenditures in the United States of foreign governments and international organizations for maintenance of their embassies, consulates, headquarters (other than employee compensation). The excluded exports amounted to 12.5 percent of the total U.S. exports in 2008,as reported by the Bureau of Economic Analysis.

The analysis of exports and wages uses individual data from the 2008 American Community Survey, which is organized and published by IPUMs.[146] This study uses iPUMs data for export industry wages instead of BLS Quarterly Census of Employment and Wages (QCEW), due to the non-disclosure of a substantial number of observations in the BLS dataset. In addition, we use the iPUMs data for the wage model analysis. The iPUMs data were available for 94 metro areas, out of the largest 100 metropolitan areas in the country.

To obtain wage data for the following metropolitan areas, the QCEW was used because IPUMS data was not available or had too few observations: Honolulu, San Francisco, Miami, Portland, Columbia, El Paso, Provo, Omaha, Stockton, Poughkeepsie, Greenville, Ogden, and Tucson. The QCEW did not report data for Ogden and Tucson so the national average wage for their leading export industries was used instead of metropolitan level data. In all other cases the American Community Survey was used via IPUMS.

We have chosen 2008 to serve as a basis of reference for the U.S. metropolitan exports. 2009 was an outlier year for U.S. exports. American exports declined by almost 11 percent in 2009, in real terms, the highest decrease since 1958.[147]

In order to test whether or not metropolitan export orientation is related to innovation, this report used new patent data from the Strumsky Patent Applications Database, which, through the work of Deborah Strumsky, aggregates and classifies historic and current patent information from the U.S. Trademark and Patent Office by geography. The data has been used in a variety of academic publications.[148]

### Geographic Definitions

This study assesses export trends across the top 100 metropolitan areas in 2008, using metropolitan statistical areas (MSAs) as defined by the Office of Management and Budget (OMB) in 2008.[149] There were 366 metropolitan areas in 2008 and this report focuses on the largest 100 metro areas by population, with at least 500,000 residents in 2008.[150] We concentrate on this group, because they collectively contain two-thirds of the nation's jobs and generate three-quarters of GDP.[151]

### Wage Model

This report investigates the relationship between individual wages and metropolitan exports. Since metropolitan area wages are likely to affect export competitiveness as well as be affected by it, regressions of metropolitan aggregates on metropolitan aggregates may be biased. One way around this problem is to relate individual wage data (since individual characteristics are unlikely to affect metropolitan area characteristics) to metropolitan averages. There are a number of empirical papers that use this method—selection through aggregation—while making the case that any resulting bias is likely to be trivial.[152]

To test the hypothesis that metropolitan exports in a given industry increase wages, the following equation will be estimated:

where $M$ = Metro, $I$ = Industry, $i$ = individual, $O$ = occupation,

$$1) \ W_{i,I,M} \ = \ X_{M,I} \ + \ S_{M,I} \ + \ Z_{i,I,M} \ + \ M_m \ + \ O_o \ + \ I_I \ + \ r$$

This equation predicts individual annual income and wages based on metro-industry export values (X), metro-industry skill levels and specialization (embedded in the vector S), a large number of individual characteristics (Z), metropolitan effects (M), occupation effects (O), and industry effects (I). Z corresponds to a list of variables that are known to affect wages and may be correlated with industry exports. These include: attaining a high school diploma, attaining a college degree, attaining a post-graduate degree, age, race, gender, number of weeks worked, whether the resident has recently moved within the last year, foreign status, years spent in the United States, and labor force status. All regression results adjust for these individual characteristics.

This model was estimated using a variety of specifications. To summarize the most noteworthy results, metro-industry exports predicted significantly higher wages controlling for any combination of the above controls, including occupational effects, industry effects, metro-industry-education, and metropolitan effects. We also find a significant export premium for workers without a high school diploma. These results are available at **www.brookings.edu/metro/exports**. In both cases, every billion dollars in metro-industry exports is associated with roughly 1 to 2 percent higher wages for individual workers in that metro-industry. One explanation for this result is that international competition demands higher worker productivity relative to domestic-oriented competition.

## APPENDIX B. Exports Produced in the 100 Largest Metropolitan Areas for 2008

| Rank | Metro Area | Total Exports 2008 (in Billion dollars) | Largest Export Industry |
|---|---|---|---|
| 1 | New York-Northern New Jersey-Long Island, NY-NJ-PA | 85.16 | Chemicals |
| 2 | Los Angeles-Long Beach-Santa Ana, CA | 78.54 | Computer and Electronic Products |
| 3 | Chicago-Naperville-Joliet, IL-IN-WI | 52.88 | Machinery |
| 4 | Houston-Sugar Land-Baytown, TX | 51.55 | Chemicals |
| 5 | Dallas-Fort Worth-Arlington, TX | 44.55 | Computer and Electronic Products |
| 6 | San Francisco-Oakland-Fremont, CA | 30.90 | Petroleum and Coal Products |
| 7 | Boston-Cambridge-Quincy, MA-NH | 28.80 | Computer and Electronic Products |
| 8 | Philadelphia-Camden-Wilmington, PA-NJ-DE-MD | 27.44 | Chemicals |
| 9 | Detroit-Warren-Livonia, MI | 26.91 | Transportation Equipment |
| 10 | Seattle-Tacoma-Bellevue, WA | 24.16 | Transportation Equipment |
| 11 | San Jose-Sunnyvale-Santa Clara, CA | 22.79 | Computer and Electronic Products |
| 12 | Portland-Vancouver-Beaverton, OR-WA | 21.95 | Computer and Electronic Products |
| 13 | Atlanta-Sandy Springs-Marietta, GA | 20.32 | Travel and Tourism |
| 14 | Minneapolis-St. Paul-Bloomington, MN-WI | 18.99 | Machinery |
| 15 | Phoenix-Mesa-Scottsdale, AZ | 18.63 | Computer and Electronic Products |
| 16 | Washington-Arlington-Alexandria, DC-VA-MD-WV | 16.94 | Business, Professional, and Technical Services |
| 17 | San Diego-Carlsbad-San Marcos, CA | 15.49 | Computer and Electronic Products |
| 18 | St. Louis, MO-IL | 14.64 | Transportation Equipment |
| 19 | Miami-Fort Lauderdale-Pompano Beach, FL | 14.59 | Travel and Tourism |
| 20 | Indianapolis-Carmel, IN | 12.79 | Chemicals |
| 21 | Cleveland-Elyria-Mentor, OH | 12.70 | Transportation Equipment |
| 22 | Cincinnati-Middletown, OH-KY-IN | 11.82 | Transportation Equipment |
| 23 | Riverside-San Bernardino-Ontario, CA | 11.54 | Transportation Equipment |
| 24 | New Orleans-Metairie-Kenner, LA | 11.22 | Petroleum and Coal Products |
| 25 | Milwaukee-Waukesha-West Allis, WI | 10.25 | Machinery |
| 26 | Austin-Round Rock, TX | 10.22 | Computer and Electronic Products |
| 27 | Pittsburgh, PA | 10.13 | Machinery |
| 28 | Denver-Aurora-Broomfield, CO | 10.10 | Business, Professional, and Technical Services |
| 29 | Charlotte-Gastonia-Concord, NC-SC | 9.96 | Chemicals |
| 30 | Hartford-West Hartford-East Hartford, CT | 9.93 | Transportation Equipment |
| 31 | Baltimore-Towson, MD | 8.95 | Chemicals |
| 32 | Columbus, OH | 8.72 | Transportation Equipment |
| 33 | Kansas City, MO-KS | 8.40 | Transportation Equipment |
| 34 | Tampa-St. Petersburg-Clearwater, FL | 7.86 | Computer and Electronic Products |
| 35 | Bridgeport-Stamford-Norwalk, CT | 7.77 | Chemicals |
| 36 | Nashville-Davidson--Murfreesboro--Franklin, TN | 7.77 | Transportation Equipment |
| 37 | Wichita, KS | 7.43 | Transportation Equipment |
| 38 | Baton Rouge, LA | 7.39 | Chemicals |
| 39 | Las Vegas-Paradise, NV | 7.27 | Travel and Tourism |
| 40 | Buffalo-Niagara Falls, NY | 7.18 | Chemicals |
| 41 | Orlando-Kissimmee, FL | 7.07 | Travel and Tourism |
| 42 | Virginia Beach-Norfolk-Newport News, VA-NC | 6.72 | Transportation Equipment |
| 43 | Rochester, NY | 6.72 | Machinery |
| 44 | Louisville-Jefferson County, KY-IN | 6.65 | Transportation Equipment |
| 45 | Providence-New Bedford-Fall River, RI-MA | 6.62 | Miscellaneous |
| 46 | San Antonio, TX | 6.52 | Transportation Equipment |

| Rank | Metro Area | Total Exports 2008 (in Billion dollars) | Largest Export Industry |
|------|------------|------------------------------------------|--------------------------|
| 47 | Sacramento--Arden-Arcade--Roseville, CA | 6.31 | Computer and Electronic Products |
| 48 | Salt Lake City, UT | 6.12 | Primary Metal |
| 49 | Greensboro-High Point, NC | 5.96 | Chemicals |
| 50 | Memphis, TN-MS-AR | 5.56 | Freight and Port Services |
| 51 | Oxnard-Thousand Oaks-Ventura, CA | 5.54 | Chemicals |
| 52 | Tulsa, OK | 5.46 | Machinery |
| 53 | Grand Rapids-Wyoming, MI | 5.27 | Transportation Equipment |
| 54 | Raleigh-Cary, NC | 4.96 | Chemicals |
| 55 | Richmond, VA | 4.95 | Chemicals |
| 56 | Dayton, OH | 4.71 | Transportation Equipment |
| 57 | New Haven-Milford, CT | 4.66 | Chemicals |
| 58 | Albuquerque, NM | 4.50 | Computer and Electronic Products |
| 59 | Birmingham-Hoover, AL | 4.29 | Primary Metal |
| 60 | Toledo, OH | 4.28 | Transportation Equipment |
| 61 | Omaha-Council Bluffs, NE-IA | 4.02 | Freight and Port Services |
| 62 | Tucson, AZ | 3.98 | Transportation Equipment |
| 63 | Oklahoma City, OK | 3.94 | Machinery |
| 64 | Albany-Schenectady-Troy, NY | 3.84 | Chemicals |
| 65 | Allentown-Bethlehem-Easton, PA-NJ | 3.83 | Chemicals |
| 66 | Fresno, CA | 3.74 | Agriculture |
| 67 | Worcester, MA | 3.73 | Computer and Electronic Products |
| 68 | Jacksonville, FL | 3.68 | Travel and Tourism |
| 69 | Akron, OH | 3.64 | Transportation Equipment |
| 70 | Youngstown-Warren-Boardman, OH-PA | 3.64 | Primary Metal |
| 71 | Syracuse, NY | 3.59 | Machinery |
| 72 | Knoxville, TN | 3.49 | Transportation Equipment |
| 73 | Greenville-Mauldin-Easley, SC | 3.48 | Machinery |
| 74 | Bakersfield, CA | 3.46 | Petroleum and Coal Products |
| 75 | Madison, WI | 3.00 | Chemicals |
| 76 | Chattanooga, TN-GA | 2.82 | Machinery |
| 77 | Boise City-Nampa, ID | 2.81 | Computer and Electronic Products |
| 78 | Springfield, MA | 2.76 | Machinery |
| 79 | Charleston-North Charleston-Summerville, SC | 2.75 | Transportation Equipment |
| 80 | Poughkeepsie-Newburgh-Middletown, NY | 2.64 | Chemicals |
| 81 | Des Moines-West Des Moines, IA | 2.58 | Machinery |
| 82 | Columbia, SC | 2.57 | Transportation Equipment |
| 83 | Harrisburg-Carlisle, PA | 2.49 | Primary Metal |
| 84 | Honolulu, HI | 2.44 | Travel and Tourism |
| 85 | Palm Bay-Melbourne-Titusville, FL | 2.43 | Computer and Electronic Products |
| 86 | Scranton--Wilkes-Barre, PA | 2.33 | Primary Metal |
| 87 | El Paso, TX | 2.30 | Primary Metal |
| 88 | Portland-South Portland-Biddeford, ME | 2.30 | Transportation Equipment |
| 89 | Little Rock-North Little Rock-Conway, AR | 2.26 | Transportation Equipment |
| 90 | Ogden-Clearfield, UT | 2.24 | Transportation Equipment |
| 91 | Modesto, CA | 2.06 | Agriculture |
| 92 | Stockton, CA | 2.03 | Agriculture |

**APPENDIX B. Exports Produced in the 100 Largest Metropolitan Areas for 2008 (continued)**

| Rank | Metro Area | Total Exports 2008 (in Billion dollars) | Largest Export Industry |
|---|---|---|---|
| 93 | Augusta-Richmond County, GA-SC | 1.99 | Transportation Equipment |
| 94 | Colorado Springs, CO | 1.94 | Computer and Electronic Products |
| 95 | Jackson, MS | 1.94 | Transportation Equipment |
| 96 | Provo-Orem, UT | 1.82 | Primary Metal |
| 97 | Bradenton-Sarasota-Venice, FL | 1.63 | Transportation Equipment |
| 98 | Lakeland-Winter Haven, FL | 1.35 | Food |
| 99 | McAllen-Edinburg-Mission, TX | 1.02 | Travel and Tourism |
| 100 | Cape Coral-Fort Myers, FL | 0.85 | Travel and Tourism |
|  | Largest 100 Metro Areas | 1036.88 | Transportation Equipment |
|  | United States | 1609.41 | Transportation Equipment |

# Endnotes

1. This study is concerned with exports of goods produced in the United States and commercial services sold by U.S. residents to foreign residents. Therefore, this study excludes from the U.S. total exports the following categories: re-exports, scrap materials, used merchandise, special provisions, government services, military transfers, and expenditures of foreign governments and international organizations in the United States for services such as maintaining their embassies, consulates or headquarters (excluding compensation of employees). This research refers to this narrower export measure as "U.S. exports", unless noted otherwise. This measure of U.S. exports is 12.5 percent less than U.S. total exports in 2008, as reported by BEA.

2. United States President Barack Obama, address before a joint session of the Congress on the State of the Union, January 27, 2010

3. Since 1929, when the Bureau of Economic Analysis (BEA) begins its time series of exports data, there have been 11 years out of a possible 76 where exports have doubled in nominal terms, with the latest occurring in 1981, and on average, doubling exports takes just over 10 years. What matters, though, are real exports, since a period of high inflation could easily lead to an increase in the nominal value of exports without a significant increase in actual production.

4. For example, the metro area of Greensboro, NC has 14—more than any other large metro—Provo-Orem, UT has 12, and Toledo has 10. This does not guarantee success in exporting, but research suggests that, all else being equal, industries are more productive, better paying, and innovative if they are clustered. For the definition of an export cluster, see Section II and **http://www.brookings.edu/metro/exports**.

5. Sources for the sidebar: For the car exports figure see The Port Authority of New York and New Jersey, "2009 Trade Statistics," available at **http://www.panynj.gov/port/trade-stats.html**

6. Andrew B. Bernard and Bradford J. Jensen, "Exceptional Exporter Performance: Cause, Effect, or Both?" *Journal of International Economics,* 47 (1) (1999): 1-25.

7. Barry Eichengreen, "The Dollar Dilemma: The World's Top Currency Faces Competition," *Foreign Affairs* 88 (5) (2009).

8. Jeffrey Frankel and David Romer, "Does trade cause growth?" American Economic Review (89) (1999): 379–399; Romain Wacziarg and Karen Horn Welch, "Trade Liberalization and Growth: New Evidence," *The World Bank Economic Review* 22 (2) (2008):187-231; Simon Kuznets, *Modern Economic Growth* (New Haven: Yale University, 1966).

9. David Ricardo, *On the Principles of Political Economy and Taxation* 3rd Edition (London: John Murray, 1821/1817).

10. James Buchanan and Yong Yoon, "A Smithean Perspective on Increasing Returns," Journal of the History of Economic Thought 22 (2000): 43-48; Russell Roberts, "Treasure Island: The Power of Trade. Part II. How Trade Transforms Our Standard of Living." (Library of Economics and Liberty, 2006), available at **www.econlib.org/library/Columns/y2006/Robertsstandardofliving.html** (April 2010).

11. To elaborate on the point, Adam Smith argues that a nail maker in a village in Scotland would have the capacity to make 300,000 nails in a year, if this was his primary activity. But there is no market for that many nails in his village, so he can only sell 1,000 nails in a year and must split his time in other fields of smithery. He has no incentive to increase the productivity of his nail making business because he can't trade with enough people. Adam Smith, *An Inquiry into the Nature and Causes of the Wealth of Nations* (London: Methuen & Co., Ltd, 1904/1776).

12. Bee-Yan Aw, "Accumulating Technology and Location Spillovers Among Firms in Taiwan's Electronics Industry," *The Journal of Development Studies* 39 (1) (2002): 94-117.

13. Bee-Yan Aw, Mark J. Roberts and Tor Winston, "Export Market Participation, Investments in R&D and Worker Training, and the Evolution of Firm Productivity," *World Economy*, 30 (1) (2007): 83-104.

14. John Tschetter, "Exports Support American Jobs" (U.S. Department of Commerce, International Trade Administration, 2010).

15. Alexander Mas, testimony before the U.S. Senate Committee on Finance, December 2, 2009, available at **http://finance. senate.gov/imo/media/doc/120909amtest1.pdf**

16. Andrew B. Bernard and Bradford J. Jensen, "Exceptional Exporter Performance: Cause, Effect, or Both?" *Journal of International Economics*, 47 (1) (1999): 1-25.

17. Niven Winchester, "Searching for the Smoking Gun: Did Trade Hurt Unskilled Workers," *The Economic Reader* 84 (265). (2008): 141-156; Mary Amiti and Donald R. Davis, Trade, Firms, and Wages: Theory and Evidence," National Bureau of Economic Research Working Paper 14106 (2008); Paul Krugman, "Trade and Wages, Reconsidered," Brookings Papers on Economic Activity Spring (2008):103-137.

18. Between 1992-2008, the U.S. average growth rate of
real GDP was 3.03 percent, higher than the European Union (EU-27), 2.15 percent or the United Kingdom,
2.66 percent. The U.S. average unemployment rate during the same period was 5.37 percent, while in the EU was 9.24 per-cent and in the UK was 6.51 percent. Source: The Economist Intelligence Unit, *Country Data- Annual Time Series* (The Economist Intelligence Unit, 2010).

19. U.S. Census Bureau, Historical Income Tables, (U.S. Census, 2010) available at **http://www.census.gov/hhes/www/income/ data/historical/index.html**.

20. Ibid.

21. Calculated based on U.S. Bureau of Economic Analysis (BEA), "Section 2: Personal Income and Outlays," *National Income and Product Accounts Tables* (U.S. Department of Commerce, May 2010).

22. Calculations based on BEA, "Table 2.1. Personal Income and Its Disposition 1980-2009," *National Income and Product Accounts Table* (U.S. Bureau of Economic Analysis, May 010)

23. Calculations based on BEA, "Table 1. U.S. International Transactions, 1960-2009," *U.S. International Transactions* (U.S. Bureau of Economic Analysis,
June 2010).

24. Calculations based on BEA, "Table 2.1. Personal Income and Its Disposition 1980-2009," *National Income and Product Accounts Table* (U.S. Bureau of Economic Analysis, May 2010)

25. U.S. Treasury Department, International Capital System: Report on Foreign Portfolio Holdings of U.S. Securities, (U.S. Treasury), available at **http://www.treas.gov/tic/fpis.shtml.**

26. Joshua Aizenman and Yothin Jinjarak, "Current Account Patterns and National Real Estate Markets," *Journal of Urban Economics* 66 (2) (2009): 75-89.

27. The Economist Intelligence Unit, *Country Data- Annual Time Series* (The Economist Intelligence Unit, 2010).

28. Bosworth and Collins found that the United States exports less than the original 15 members of the European Union and Japan, based on an analysis of the relationship between their exports and economic size, distance and a number of other trade-related variables. The dataset consisted of the import and export flows of each of the mentioned countries with 162 other countries during 1980 - 2005. For more information see Barry Bosworth and Susan Collins, "Determinants of U.S. Exports to China," *Asian Economic Papers*, 2008, Vol. 7, No. 3: 1-26.

29.  William R. Cline and John Williamson, "2009 Estimates of Fundamental Equilibrium Exchange Rates," (Washington: The Peterson Institute, 2009); Martin Neil Baily and Robert Z. Lawrence, "Competitiveness and the Assessment of Trade Performance," in Michael Mussa, ed., *C. Fred Bergsten and the World Economy* (Washington: Peterson Institute for International Economics, 2006).

30.  U.S. Department of Commerce, "Secretary Locke, Postmaster General Potter Launch New Initiative to Boost U.S. Exports" ( U.S. Department of Commerce, July 12, 2010).

31.  The Trade Promotion Coordinating Committee (TPCC), 2008 National Export Strategy, 2008.

32.  BEA, "Table 1. Ownership-Based Framework of the U.S. Current Account, 1982-2008," International Economic Accounts, (U.S. Bureau of Economic Analysis, 2010).

33.  All the growth rates are in real terms, from 2005 chained dollars values, unless noted otherwise. Calculated based on BEA 2010.

34.  The World Trade Organization (WTO), *International Trade Statistics 2009* (The World Trade Organization, 2009).

35.  Personal communication from Andrew Eilts, International Trade Specialist, General Electric, July 02, 2010.

36.  The World Trade Organization (WTO), *International Trade Statistics 2009.*

37.  This excludes military transfers and government services from services exports. U.S. Bureau of Economic Analysis (BEA), International Economic Accounts, Table 1: U.S. International Transactions (U.S. Department of Commerce, June 2010).

38.  Ibid.

39.  U.S. Bureau of Economic Analysis (BEA), International Economic Accounts, Trade in Services (U.S. Department of Commerce, 2009) and WTO, International Trade Statistics 2009.

40.  WTO, International Trade Statistics 2009, Table I.10: Leading exporters and importers in world trade in commercial services, 2008. This ranking reports private service exports by country.

41.  GDP annual real growth average calculated based on U.S. Bureau of Economic Analysis (BEA), Table 1.1.6. Real Gross Domestic Product, Chained Dollars 1929-2009, *National Income and Product Accounts Tables* (U.S. Department of Commerce, May 2010). The U.S. exports growth by industry calculated based on U.S. Bureau of Economic Analysis, Table 1. Trade in Services, 1992-2008 (Department of Commerce, March 2010), U.S. International Trade Commission, U.S. Domestic Exports, NAICS codes 1997-2009 (Department of Commerce, May 2010), inflation adjusted with the Production Price Indexes for goods exporting industries from the U.S. Bureau of Labor Statistics, Producer Price Indexes (Department of Labor, June 2010), and for agricultural exports and service exports with the specific price indexes for exports from U.S. Bureau of Economic Analysis, Table 4.2.4 Price Indexes for Exports and Imports for Goods and Services by Type of Product, *National Income and Product Accounts Tables* (U.S. Department of Commerce, May 2010).

42.  The International Monetary Fund (IMF), World Economic Outlook Database, (The International Monetary Fund, April 2010).

43.  Stuart Rosenthal and William Strange, "Evidence on the Nature and Sources of Agglomeration Economies," in J.V. Henderson and J. F. Thisse, ed., *Handbook of Regional and Urban Economics*, vol. 4 (Amsterdam: North-Holland, 2004); David B. Audretsch and Maryann Feldman, "R&D Spillovers and the Geography of Innovation and Production," *American Economic Review* 86 (3) (1996):630-640; Antonio Ciccone and Robert E. Hall, "Productivity and the Density of Economic Activity," *American Economic Review* 86 (1) (1996): 54-70; Timothy Besley, Torsten Persson, and Daniel Sturm, Political Competition and Economic Performance: Theory and Evidence From The United States," Working Paper 11484 (Cambridge: National

Bureau of Economic Research, 2005); Jordan Rappaport and Jeffrey D. Sachs, "The United States as a Coastal Nation," *Journal of Economic Growth* 8 (1), 2003: 5-46; Stephen Knack, "Social capital and government performance: Evidence from the states," *American Journal of Political Science* 46 (2002): 772–785.

44.   Paul Krugman, *Geography and Trade* (Cambridge, MA: The MIT Press, 1991).

45.   Alfred Marshall, *Principles of Economics* (London: Macmillan and Co, 1890).

46.   Enrico Moretti, "Estimating the social return to Higher Education: Evidence from Longitudinal and Repeated Cross-Sectional Data," *Journal of Econometrics* 121 (2004): 175-212; Adam B. Jaffe, Manuel Trajtenberg and Rebecca Henderson, "Geographic localization of knowledge spillovers as evidenced by patent citations," *Quarterly Journal of Economics* 577 (1993); Jung Won Sonn and Michael Storper, "The Increasing Importance of Geographical Proximity in Technological Innovation: An Analysis of U.S. Patent Citations, 1975-1997," UCLA Working Paper, (UCLA, 2003); Luis M.A. Bettencourt, Jose' Lobo, and Deborah Stumsky, "Invention in the City: Increasing Returns to Patenting as a Scaling Function of Metropolitan Size," Research Policy 36 (2007): 107-120; Alan Berube, "MetroNation: How U.S. Metropolitan Areas Fuel American Prosperity" (Washington: Brookings Institution, 2007).

47.   Mark Muro and others, "MetroPolicy: Shaping a New Federal Partnership for a Metropolitan Nation" (Washington: Brookings Institution, 2008).

48.   Adie Tomer and Robert Puentes, "Expect Delays: An Analysis of Air Travel Trends in the United States," (Washington: Brookings Institution, 2009).

49.   Bernard and Jensen, "Exceptional Exporter Performance: Cause, Effect, or Both?" 1999; Mark Muro and others, "MetroPolicy: Shaping a New Federal Partnership for a Metropolitan Nation," 2008. Science and engineering job figures were calculated from the National Science Board, *Science and Engineering Indicators 2008* (Arlington: National Science Foundation, 2009).

50.   Rui Baptista and Peter Swann, "Do firms in clusters innovate more?" *Research Policy* 27 (5) (1998): 525-540.

51.   Rosenthal and Strange, "Evidence on the Nature and Sources of Agglomeration Economies," 2004.

52.   Purdue University's Center for Regional Development and Indiana University's Indiana Business Research Center, *Unlocking Rural Competitiveness: The Role of Regional Clusters,* (January 2007) available at http://**www.ibrc.indiana.edu/innovation/ reports/sections/3_project1.pdf.**

53.   For more on the top 100 metro areas economic performance during recession, see *MetroMonitor* (Washington: The Brookings Institution, 2010) available at **http://www.brookings.edu/metro/MetroMonitor.asp**x.

54.   Bee-Yan Aw, "Accumulating Technology and Location Spillovers Among Firms in Taiwan's Electronics Industry," *The Journal of Development Studies* 39 (1) (2002): 94-117.

55.   This study uses the U.S. Bureau of Economic Analysis definition of "exports" as goods or services sold by U.S. residents to foreign residents. Therefore, this study's export estimates for the largest 100 U.S. metropolitan areas do not include sales from a U.S. metropolitan area to the U.S. market. In addition, the exports include sales from the U.S. companies' headquarters to their subsidiaries abroad and the sales of foreign companies located in the United States to entities located abroad. For more information see U.S. Bureau of Economic Analysis, *International Economic Accounts*, (Department of Commerce, 2009).

56.   Census Bureau collects the export data based on an Origin of Movement (OM) ZIP-code-based methodology. This means that the export data is allocated based on the ZIP code of the company in the U.S. that is compensated for the export (the United States Principal Party in Interest (USPPI)). This methodology has been introduced in 2005, due to the use of the Automated Export System by the U.S. Customs Bureau and the Census Bureau instead of the shipper's export declaration. International Trade Administration (ITA), *Exports from U.S. Metropolitan Areas Methodology* (Department of Commerce, 2009), available at **http://www.ita.doc.gov/td/industry/otea/metro/methodology_2008.html**.

57. This is similar to the state Origin of Movement Zip code based export series. U.S. Census Bureau, *Guide to Foreign Trade Statistics* (Department of Commerce, 2009), available at **http://www.census.gov/foreign-trade/guide/sec2.html.**

58. This assumption does not take into account different export propensities of metropolitan areas that produce similar shares of the industry's national output. Therefore, the most accurate way to interpret the rankings of metropolitan export indicators is that they measure the metropolitan contribution to export industries, rather than the direct contribution to exports per se.

59. While this method allows for the inclusion of wider range of royalties earning industries, it does not take into consideration the different locations of the production and research and development facilities of a company, due to lack of data.

60. This result was based on the bi-decennial 2007 Commodity Flows Survey (CFS). To estimate create an alternative measure of export orientation, the CFS was used to calculate the percentage of goods shipped outside the metropolitan area as a percentage of all goods shipped (some goods were shipped internally) for 59 MSAs. This value should be positively correlated with the value of goods exported internationally divided by the value of all goods produced. This value was constructed using Brookings exports data and ITA data. The Brookings estimates of 2008 export orientation show a strong positive relationship with the CFS measure of export orientation (correlation coefficient=.36 and statistically significant), while the 2008 ITA data has a negative (-0.16) correlation and is statistically insignificant. The CFS includes 44 Combined Statistical Areas (CMAs) and 15 MSAs. The CMA estimates are comparable with the MSA estimates, given that MSAs concentrate about 86 percent of the employment in CMAs across the largest 100 metropolitan areas, on average. In fact, a concordance measure (i.e. employment in the MSA divided by employment in the CMA) between the CMAs and the MSAs was used as an analytic weight to confirm this. The results were similar: when weighting by concordance, the Brookings export orientation measure had a correlation coefficient of 0.37 with the CFS export orientation measure and ITA's had a coefficient of -0.04. For data and more information, see The Bureau of Transportation Statistics, Commodity Flow Survey (U.S. Department of Transportation, 2009), available at **http://factfinder.census.gov/servlet/IBQTable?_bm=y&-geo_id=D&-ds_name=CF0700A20&-_lang=en**.

61. 1) Using the Brookings data, 2008 exports of goods as a share of GMP is very strongly correlated with the 2008 share of employment in manufacturing 0.80, while the ITA 2008 exports as a share of GMP has just a correlation of 0.12 with the manufacturing share of employment. In the end, however, the Brookings data are estimates, and a preferable solution would be for the Census Bureau or BEA to create origins of production data that directly measures exports from companies at the county level.

62. In other words, export sales are divided by a pure measure of metropolitan production, gross-value-added. From the perspective of a metropolitan area, the final sales price for an export product equals gross value added plus intermediate value added, where intermediate value added may come from the same company, another company in the same metropolitan area, a U.S. company located elsewhere, or a foreign supplier.

63. The correlation coefficient between metropolitan exports and Gross Metropolitan Product in 2008 is 0.94, showing the high positive association between the two series.

64. This U.S. export intensity is adjusted to conform to the export numbers calculated for the top 100 metros. As discussed in the methodology, it excludes domestic exports of goods which are not production (the NAICS 900s category), and government services exports. The U.S. export intensity calculated with the BEA total U.S. exports was 12.7 percent in 2008.

65. The correlation coefficient between metropolitan export intensity and the share of manufacturing in metropolitan exports is 0.77.

66. Sources for the Sidebar: Source of U.S. aviation industry numbers- General Aviation Manufacturers Association, 2009 General Aviation- Statistical Databook and Industry Outlook (General Aviation Manufacturers Association, 2010). For Cessna's export figures- Personal communication from Robert Stangarone, Vice President of Corporate Communications, Cessna Aircraft Company, June 30, 2010. For Ex-Im Bank loan, see Export- Import Bank of the United States, Ex-Im Bank Authorizes $500 Million Facility To Textron To Support Exports Of Cessna Aircraft And Bell Helicopters, available at **http://www.exim.gov/pressrelease.cfm/68B8E446-E156-4C05-7741251C06465832/]** (May 2009). For Hawker Beechcraft's export figures- Personal communication from Nicole D. Alexander, Public Relations Representative, Hawker Beechcraft Corporation,

July 09, 2010; For Cox Machine, Inc- Personal communication from Jason Cox, Chief Technical Officer, Cox Machine, Inc, July 2, 2010; For Perfekta, Inc's exports- Personal communication from Julian Guerra, President, Perfekta, Inc, July 6, 2010.

67.    Zoltan J. Acs and David B. Audretsch, "Innovation in Large and Small Firms: An Empirical Analysis Source," *The American Economic Review,* 78 (4) (1988): 678-690.

68.    To test this formally, the metropolitan export share of GMP was regressed on the 2008 manufacturing share of employment and the patent rate from 2001 to 2008, adjusting for state fixed effects. The relationship between patent rate and export share of GMP was highly significant, with a t-statistic of 3.8. This relationship was robust to including the share of employees working for universities, the share of employment in marine cargo handling, and the number of oil and coal fields in the metropolitan area.

69.    Wichita Metro Chamber of Commerce, *Wichita Metro Business & Industry Profile*, available at **http://www.wichitakansas.org/ economic_development-wichita_metro_profile-business_industry.php.**

70.    Portland Development Commission, Portland Economic Development Strategy, (Portland Development Commission, 2009), available at **http://pdxeconomicdevelopment.com/index.html**

71.    International Trade Administration, U.S. Foreign Trade Zones, (U.S. Department of Commerce, 2009) available at **http:// ia.ita.doc.gov/ftzpage/letters/ftzlist.html**

72.    Ibid.

73.    The iPUMs dataset does not provide sufficient data points for six metro areas out of the largest 100 metro areas: Bradenton, FL, Greenville, SC, Ogden, UT, Oxnard, CA, Poughkeepsie, NY and Tucson, AZ

74.    This export effect is robust to the inclusion of not only individual characteristics but also metropolitan, industrial, and occupational characteristics. That is to say: even in the same industry and occupation, workers earn more in metros where export production is higher. Likewise, workers in high export industries earn more than workers in low export industries even if they work the same metro.

75.    Bee-Yan Aw, "Accumulating Technology and Location Spillovers Among Firms in Taiwan's Electronics Industry," *The Journal of Development Studies* 39 (1) (2002): 94-117.

76.    BLS, *Quarterly Census of Employment and Wages* (U.S. Bureau of Labor Statistics, 2010).

77.    On the lower end of export industries, workers in Administration and Support services earned just $31,000 on average in San Jose. Those in Nursing and Residential Care earned just $27,000. Those in New York government earned $38,000. Those in Administration and Human Resource Programs, which is not attributed with any exports, earned $27,000 in Portland.

78.    Steven Ruggles, Matthew Sobek, Trent Alexander, Catherine A. Fitch, Ronald Goeken, Patricia Kelly Hall, Miriam King, and Chad Ronnander. *Integrated Public Use Microdata Series: Version 4.0.* (Minneapolis, MN: Minnesota Population Center, 2009) available at **http://usa.ipums.org/usa.**

79.    UN Department of Economic and Social Affairs, "Global Urbanization Rate from 1950 to 2050," *World Urbanization Prospects* (United Nations, 2007).

80.    While the usual large emerging markets group is Brazil, Russia, India, China, we excluded Russia from the analysis, because Russia is a very small export market for the United States. In 2008, U.S. exports of domestic goods to Russia were only 8.7 billion dollars, only 0.5 percent of U.S. exports of domestic goods and private services. U.S. exports to Russia are not even reported separately by the Bureau of Economic Analysis. For U.S. goods services exports to Russia, see USITC, Interactive Trade and Tariff DataWeb (Department of Commerce, 2010).

81.     Calculation based on IMF, International Monetary Fund, *World Economic Outlook Database*, (April 2010).

82.     Calculation based on Homi Kharas and Geoffrey Gertz, "The New Global Middle Class: A Cross Over from West to East."In Cheng Li, ed., *China's Emerging Middle Class: Beyond Economic Transformation* (Washington: Brookings, 2010).

83.     For more on the evolution of the federalist model and implementation in the United States see Robert P. Inman and Daniel L. Rubinfeld, "Rethinking Federalism," *The Journal of Economic Perspectives* 11 (4) (1997: 43-64; and Wallace E. Oates, "Toward A Second-Generation Theory of Fiscal Federalism," *International Tax and Public Finance*, 12, (2005): 349–373.

84.     Wallace Oates, *Fiscal Federalism* (New York: Harcourt, Brace, Jovanovich, 1972).

85.     Alice Rivlin, *Reviving the American Dream* (Washington: The Brookings Institution, 1992).

86.     Andrew B. Bernard and J. Bradford Jensen, "Entry, Expansion, and Intensity in the U.S. Export Boom, 1987–1992," *Review of International Economics*, 12(4) (2004): 662-675.

87.     Most of the attention has been on the Chinese yuan. For example, Cline and Williamson from the Peterson Institute estimated a 40 percent overvalue of the dollar against the Chinese currency in 2009. Paul Krugman has been very vocal on the Chinese exchange rate policy. In addition, as recent as last March, the International Monetary Fund (IMF) Managing Director, Dominique Strauss- Kahn has declared that the Chinese yuan remains undervalued. See William R. Cline and John Williamson, "2009 Estimates of Fundamental Equilibrium Exchange Rates," Policy Brief No. PB09-10, (Washington D.C.: Peterson Institute of International Economics, June 2009); Paul Krugman, "Taking on China," *New York Times,* March 14, 2010; Nicholas Winning, "IMF Head Says Yuan Remains Undervalued," *Wall Street Journal*, March 17, 2010.

88.     Sherle Schwenniger and Samuel Sherraden, *Getting Serious About Doubling U.S. Exports* (Washington, D.C.: New America Foundation, March, 2010).

89.     Aaditya Mattoo and Arvind Subramanian, "Currency Undervaluation and Sovereign Wealth Funds: A New Role for the World Trade Organization," Working Paper 08-2 (The Peterson Institute for International Economics, 2008).

90.     Emerging markets in Asia refer to China, India, Indonesia, Malaysia, Philippines, Thailand and Vietnam. International Monetary Fund, *World Economic Outlook Update,* (IMF, July 7, 2010), available at **http://www.imf.org/external/pubs/ft/weo/2010/ update/02/index.htm#tbl1**

91.     Andrew B. Bernard, J. Bradford Jensen, Stephen J. Redding, and Peter K. Schott, "The Margins of Trade," NBER Working Paper Series 14662, (Cambridge, MA: National Bureau of Economic Research, January 2009).

92.     Scott L. Baier and Jeffrey H. Bergstrand, "Do Free Trade Agreements Actually Increase Members' International Trade?" Working Paper 2005-3 (Federal Reserve Bank of Atlanta, 2005).

93.     To study the effect of FTAs on the ratio of exports to imports, an analysis was conducted on all 17 countries with FTAs with the USA according to the International Trade Administration using goods data from the USITC. The average ratio of exports to imports was calculated three years prior to the year the FTA was enacted and three years after. The difference between these two ratios was taken to approximate the effect of the FTA on the trade balance. Two countries—Israel and Costa Rica— were excluded because data before the FTA for Israel could not be obtained, and the Costa Rican FTA was enacted in 2009, which did not allow an observation for its effect. Of the 15 countries that remained, the United States saw an increase in the ratio of exports to imports for 11 of them, including important trading partners such as Australia, Chile, and Singapore. The overall trade balance, however, decreased from -11.0 Bil to -34.2 Bil, but this negative effect was driven by Mexico and Canada. Excluding those two, FTA increased the trade balance from 1.3 blns USD to 14.9 BLNS USD. In summary, while this exercise does not isolate the causal effect of FTAs, it suggests that most FTA agreements have improved the balance of trade in goods for the United States.

94. The Trans-Pacific Partnership, signed in 2005, is a multilateral free trade agreement focused on Asia- Pacific between Australia, Brunei, Chile, New Zealand, Peru, Singapore, and Vietnam. The European Union started negotiations with India in 2007 and the plan is to finalize the agreement by the end of 2010. The China- ASEAN free trade area came into effect on January 1, 2010. For more on the Trans-Pacific Partnership, see Office of the United States Trade Representative, "USTR Fact Sheet: Trans-Pacific Partnership," December 08, 2009, available at **http://www.ustr.gov/about-us/press-office/fact-sheets/2009/november/ustr-fact-sheet-trans-pacific-partnership**. On the EU- India free trade agreement negotiations, see Pallavi Aiyar, "Hope Floats for EU- India Free Trade Pact Talks," *The Business Standard,* April 13, 2010. On the China-ASEAN free trade area, see "China- ASEAN Free Trade Agreement," *The Economist,* January 7, 2010.

95. Robert Atkinson and Howard Wial, *Boosting Productivity, Innovation, and Growth through a National Innovation Foundation* (Washington D.C.: The Brookings Institution, 2008).

96. James Duderstadt and others, *Energy Discovery-Innovation Institutes: A Step toward America's Energy Sustainability* (Washington D.C.: The Brookings Institution, 2009).

97. Gregory Tassey, *Rationales and Mechanisms for Revitalizing U.S. Manufacturing R&D Strategies* (Gaithersburg, MD : National Institute of Standards and Technology, 2009).

98. President Obama, remarks at the National Academy of Sciences Annual Meeting, Washington, D.C.: National Academy of Sciences, April 27, 2009.

99. For more on U.S. manufacturing competitiveness, see Robert Atkinson, "Innovation and U.S. Manufacturing Competitiveness," remarks at the Manufacturing Extension Partnership, May 3, 2010.

100. Atkinson and Wial, *Boosting Productivity,* 2008.

101. Karen G. Mills, Elisabeth B. Reynolds, Andrew Reamer, *Clusters and Competitiveness: A New Federal Role for Stimulating Regional Economies* (Washington D.C.: The Brookings Institution, 2008).

102. For more information on the EDA RIC program see U.S. Economic Development Administration, Regional innovation Clusters, available at http://www.eda.gov/AboutEDA/RIC/ . For more information on the energy regional innovation cluster (E-RIC) see U.S. Department of Energy, *Energy Regional Innovations Cluster Q&As,* available at **http://www.energy.gov/hubs/eric_qanda.htm**

103. This follows the concept of the energy discovery innovation institutes (e-DII) proposed by Duderstadt and others. *Energy Discovery-Innovation Institutes,* 2008.

104. Tassey, *Rationales and Mechanisms,* 2009.

105. Karen Mills, Elisabeth B. Reynolds, and Andrew Reamer, *Clusters and Competitiveness: A New Federal Role for Stimulating Regional Economies* (Washington: Brookings Institution, 2008).

106. Bruce Katz, "Restoring Prosperity: Repositioning Southern Nevada for the Next Economy," remarks given at University of Nevada, Las Vegas, April 5, 2010.

107. Gregory Tassey, *The Technology Imperative,* Edward Elgar Publishing, 2007; Tassey, *Rationales and Mechanisms*.

108. U.S. Executive Order 13534 of March 11, 2010, *National Export Initiative*.

109. Yager, "Observations on U.S. Trade," 2009.

110. Daniel Lederman, Marcelo Olarreaga, and Lucy Payton, "Export promotion agencies revisited," Policy Research Working Paper Series 5125 (Washington DC: The World Bank, 2009). Andrew K. Rose, 2007. "The Foreign Service and Foreign Trade: Embassies as Export Promotion," *The World Economy,* 30(1) (2007): 22-38.

111. GAO, "International Trade: Effective Export Programs Can Help in Achieving U.S. Economic Goals", GAO-09-480T (U.S. Government Accountability Office, March, 2009).

112. John McAdams. Senior Vice President of Export- Import Bank of the United States, remarks at the Metropolitan Leadership Council, Metropolitan Policy Program, June 11, 2010.

113. At this point, it is clear only that the FY 2011 budget is requesting a 20 percent increase for ITA, of about $78 million. As the Secretary of the Department of Commerce stated "The ITA plans to bring on as many as 328 trade experts—mostly in foreign countries—
to advocate and find customers for U.S. companies." For more information, see Gary Locke, U.S. Secretary of Commerce, "National Exports Initiative Remarks," February 4, 2010, available at **http://www.commerce.gov/NewsRoom/ SecretarySpeeches/PROD01_008893**

114. Ibid.

115. Sources for the Sidebar: Export- Import Bank of the United States, *Powering Jobs, Sales, and Profits Through Exports* (Export- Import Bank of the United States, 2010) available online at **http://www.exim.gov/pubs_center/brochures/bro-aov-01.pdf**; Urvaksh Karkaria, Suniva CEO, "Next Year Big for U.S. Solar," *Atlanta Business Chronicle,* August 5 2009; Personal communi- cation from Bryan Ashley, Chief Marketing Officer, Suniva, June 29, 2010; Suniva, Inc, About the company, available at http:// www.suniva.com/aboutthecompany.php (June 2010).

116. Howard Rosen, remarks at the Metropolitan Leadership Council, 2010.

117. The Bay Area Council Economic Institute, *International Trade and the Bay Area Economy: Regional Interests and Global Outlook 2008* (The Bay Area Council Economic Institute, September 2008); Trade Development Alliance of Greater Seattle, *The Target Market Report* (Trade Development Alliance of Greater Seattle, 2009). Sources for the Sidebar: Personal commu- nication from Bill Stafford, President, of the Trade Development Alliance of Greater Seattle, June 18, 2010; Trade Development Alliance of Greater Seattle, A Regional Partnership, available at **http://www.seattletradealliance.com/about/about-us.php**( June 2010).

118. Brookings analysis of the Commodity Flow Survey 2007.

119. Brookings analysis of U.S. DOT data. Data source: U.S. Department of Transportation. *America's Freight Transportation Gateways* (U.S. Department of Transportation, 2009), available at **http://www.bts.gov/publications/americas_freight_ transportation_gateways/2009/appendix/html/table_appendix.html**

120. Robert Puentes, Develop a Competitive National Transportation Agenda, the Auto Summit, May 18, 2010.

121. Robert Puentes, *A Bridge to Somewhere: Rethinking American Transportation for the 21st Century* (Washington D.C.: Brookings Institution, 2008).

122. Germany created a national freight policy to support its major ports and airports in the summer of 2008. See German Federal Ministry of Transport, Building, and Urban Development, *Freight Transport and Logistics Masterplan* (BMVBS, 2008).

123. For more on the National Infrastructure Bank, see Emilia Istrate and Robert Puentes, *Investing for Success: Examining a Federal Capital Budget and a National Infrastructure Bank* (Brookings Institution, December 2009).

124. For more on measuring the effectiveness of export promotion strategies see Yager, "Observations on U.S. Trade," 2009.

125. GAO, Export Promotion, 2009.

126. Source for the Venice sidebar: Organization for Economic Cooperation and Development (OECD), Examples of Best Regional Policy Practices in the OECD (OECD, 2010).

127. Trade Promotion Coordinating Committee (TPCC), 2008 *National Export Strategy,* 2008.

128. Personal communication from Bryan Borlik, EDA Director of Trade Adjustment Assistance, May 05, 2010.

129. This is similar with the state Origin of Movement Zip code based export series. U.S. Census Bureau, Guide to Foreign Trade Statistics (Department of Commerce, 2009), available at **http://www.census.gov/foreign-trade/guide/sec2.html**.

130. The Gross Metropolitan Product (GMP) is the Gross Domestic Product counterpart at the metropolitan level. In the same vein as the national indicator, the GMP by industry shows the value added produced by that industry in a certain metropolitan area.

131. We constructed two alternative export estimates based on employment for 2007, using Moody's Economy.com series and U.S. Census County Business Patterns database. These series exhibited correlation coefficients of 0.98 and 0.97 respectively, with this study's output- based export estimates.

132. While this method allows for the inclusion of wider range of royalties earning industries, it does not take into consideration the different locations of the production and research and development facilities of a company, due to lack of data.

133. William Testa, Thomas Klier, and Alexei Zelenev, "Estimating U.S. Metropolitan Area Export and Import Competition," *Economic Perspective* (Federal Reserve Bank of Chicago, 2003).

134. Nora Brooks, "U.S. Agricultural Trade Update—State Exports," *Economic Research Service Outlook Report,* FAU-102-01 (U.S. Department of Agriculture, 2005).

135. The BEA estimates a provisional county output, by allocating the state output based on the county share of the earnings in a certain industry from the state earnings in the same industry. These provisional county outputs are added to the level of a metropolitan area to produce the Gross Domestic Product by metro area (or Gross Metropolitan Product). See BEA," Introducing New Measures of the Metropolitan Economy," *Survey of Current Business* (U.S. Department of Commerce, November 2007).

136. In the end, however, the Brookings data are estiamates, and the Census Bureau or BEA should collaborate to create origins of production data that directly measures exports from companies at the county level.

137. C. Fred Bergsten, "Correcting the Chinese Exchange Rate: An Action Plan," Testimony before the Committee on Ways and Means, U.S. House of Representatives March 24, 2010.

138. This study uses Moody's GMP estimates from November 2009. These estimates might have been revised in the meantime by Moody's Economy.com.

139. The U.S. goods export codes are based on the Harmonized System (HS) established by the World Customs Organization (WCO). They are administered by the Census in the Schedule B, an approximately 8,000 commodity classifications. Census also classifies U.S. output by industry according to the North American Industry Classification System (NAICS) since 1997. While the U.S. export codes are based on product characteristics, the NAICS codes may also take into account the method of production. They do not overlap entirely, but Census developed a matching system between the HS and NAICS. See U.S. Census Bureau, Commodity Master Record Layout (U.S. Department of Commerce, 2009), available at http://www.census.gov/foreign-trade/reference/products/catalog/cmdtymst.html. For a discussion of the relationship between the HS and NAICS codes see Justin R. Pierce and Peter K. Schott, *A Concordance Between Ten-Digit U.S. Harmonized System Codes and SIC/NAICS Product Classes and Industries,* U.S. Census Bureau Center for Economic Studies, Working Paper 09-41, (U.S. Department of Commerce, 2009).

140. This study is concerned only with the cross- border services sales. For cross-border trade, data on the majority of types of private services are collected on the *Quarterly Survey of Transactions in Selected Services and Intangible Assets with Foreign Persons and the Quarterly Survey of Transactions between U.S. Financial Services Providers and Foreign Persons.* For more information see Jennifer Koncz and Anne Flatness, U.S. International Services - Cross-Border Trade in 2007 and Services Supplied through Affiliates in 2006, *Survey of Current Business*, (U.S. Department of Commerce, October 2008).

141. The Census Bureau reports in its Service Annual Survey the estimated export revenue of establishments in select industries by NAICS. However, this survey does not provide export estimates for a number of important service industries such as travel or passenger transportation. Unlike the HS- NAICS goods match-up by Census, there is no concordance table for the service exports by NAICS and the BEA service exports category. This is understandable, given that services are not provided only by service industry. For example, manufacturing firms can accrue royalties from their patents and trademarks. We constructed initially a match-up between the BEA services export categories and 6 digit level NAICS. However, due to the lack of detail beyond 4 digit NAICS for GMP by industry in the utilized dataset, Moody's Economy.com, we restricted our match up for services exports to 4 digit NAICS level. While more NAICS digit numbers allow for more detailed industry identification, we use this match up only to calculate the metro industry share out of the national total. For the concordance file, see Appendix.

142. The USITC goods exports are on a Census basis, while the BEA services exports are on a Balance of Payments (BOP) basis. The BEA adjusts the goods exports to bring them to a BOP basis, in order to have a more accurate U.S. total goods and services exports value. However, the differences between the Census basis and the BOP basis are very small at the national level- the sum of U.S. goods exports on a Census basis and services exports on a BOP basis was 99.96 percent of the BEA U.S. total exports in 2008. For more information on the definitions and differences between Census basis and BOP basis see U.S. International Trade Administration, Trade Data Basics, (U.S. Department of Commerce, 2009), available at **http://ita.doc.gov/td/industry/otea/trade_data_basics.html#exports**.

143. Institute of International Education, "Table: International Student Enrollment by Institution, Listed Alphabetically, 2008/09," *Open Doors 2009 Report on International Educational Exchange* (Institute of International Education, November 2009).

144. While our study is concerned with the 2008 figures, the 2007 IRS industry receipts from royalties were the latest series available. See IRS, "Table 7: Corporation Returns With Net Income --Balance Sheet, Income Statement, Tax, and Selected Other Items, by Major Industry, Tax Year 2007," SOI Tax Stats, (The Internal Revenue Service, March 2010).

145. The goods export categories are all the 3 digit NAICS level reported by USITC, excluding the 900s. The services categories are the most detailed level reported by the BEA for the cross-border services.

146. The American Community Survey samples Public Use Micro Areas, rather than counties or other geographical units. PUMAs do not directly overlap with Metropolitan Statistics Areas (MSAs), and IPUMS organizes the data according to MSAs as defined in 2000. Since the export data uses the more up-to-date 2008 definitions of MSAs, a cross-walk was used to match PUMAs to the new MSA. The results are robust to using the old MSA categories, but this procedure is not as accurate. IPUMS data is from Steven Ruggles, Matthew Sobek, Trent Alexander, Catherine A. Fitch, Ronald Goeken, Patricia Kelly Hall, Miriam King, and Chad Ronnander, *Integrated Public Use Microdata Series: Version 4.0.* (Minneapolis, MN: Minnesota Population Center, 2009) available at **http://usa.ipums.org/usa**.

147. See U.S. BEA," Table 1.1.1. Percent Change From Preceding Period in Real Gross Domestic Product," National Economic Accounts (U.S. Department of Commerce, 2009).

148. Luis M.A. Bettencourt, Jose Lobo, and Deborah Strumsky, "Invention in the City: Increasing Returns to patenting as a scaling function of metropolitan size," *Research Policy* (36) (2007): 107-120; Jose Lobo and Deborah Strumsky, "Metropolitan patenting, inventor agglomeration and social networks: A tale of two effects," *Journal of Urban Economics* (63) (2008): 871-884.

149.  OMB defines Metropolitan Statistical Areas as regions with "at least one urbanized area of 50,000 or more population, plus adjacent territory that has a high degree of social and economic integration with the core as measured by commuting ties". U.S. OMB, "Update of Statistical Area Definitions and Guidance on Their Uses," *OMB Bulletin No. 09-01* (United States Office of Management and Budget, 2008).

150.  U.S. Census Bureau, "2008 Subject Definitions," *American Community Survey 2008* (Department of Commerce, 2009).

151.  Mark Muro and others, *MetroPolicy,* 2008.

152.  William Wheaton and Mark Lewis, "Urban Wages and Labor Market Agglomeration," *Journal of Urban Economics,* 51 (2002): 541-562; David Card and Jesse Rothstein, "Racial Segregation and the Black-White Test Score Gap" *Journal of Public Economics* 91(11-12) (2007): 2158-2184.

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