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How the Small Businesses Investment Company Program can better support America's advanced industries

Testimony Submitted to
U.S. Senate
Committee on Small Business & Entrepreneurship

"Reauthorization of SBA's Small Business Investment Company Program"

June 26, 2019

Mark Muro
Senior Fellow
Brookings Institution
Metropolitan Policy Program

Chairman Rubio, Ranking Member Cardin, and Members of the Committee:

Thank you for inviting me to testify today on the reauthorization of the Small Business Administration (SBA) and particularly on the Small Business Investment Company (SBIC) program.

My expertise revolves around what my group at Brookings calls America's advanced industry sector, and so my priority today is to suggest that the SBIC should be better positioned to further support the sector.

Specifically, I want to urge that the committee explicitly prioritize advanced manufacturing enterprises when it revisits the SBIC's activities during the broader reauthorization process.

Because not all industries matter equally to America's prosperity. Indeed, these high-productivity, high-pay innovation industries anchor American competitiveness, and matter inordinately to the nation's prosperity.

For that reason, it would be extremely appropriate and helpful if the SBA reauthorization would as much as possible nudge the SBA's—and the SBICs'—services and resources

toward the support of advanced industry growth and competitiveness, particularly at a time of renewed economic nationalism in the world.

To argue this, I would like to provide three sets of comments, touching on:

- What advanced industries are and why they matter
- Why they need government financial support
- What such support might look like

AMERICA'S ADVANCED INDUSTRIES: WHAT THEY ARE AND WHY THEY MATTER

What are advanced industries, and why do they matter? Characterized by their heavy use of technology and technical workers, advanced industries represent the prime site in developed economies for the conversion of technical invention into industrial-scale business enterprise. In short, these industries anchor American prosperity.[1]

Brookings defines advanced industries as those in which R&D spending per worker reaches the top 20 percent of all industries and the share of workers with significant STEM knowledge exceeds the national average.

Based on this definition, the U.S. advanced industries sector encompasses 50 diverse industries, including 3 energy, 35 manufacturing, and 12 service industries. These prime industries include manufacturing industries such as automaking, aerospace, pharmaceuticals, and semiconductors; energy industries such as oil and gas extraction and renewables; and critical service activities such as R&D services, software design, and telecommunications.[2]

Defining Advanced Industries

Individual advanced industries are identified using two criteria:

- An industry's R&D spending per worker must fall in the 80th percentile of industries or higher, exceeding $450 per worker
- The share of workers in an industry whose occupations require a high degree of STEM knowledge must also be above the national average, or 21 percent of all workers

An industry must meet both criteria to be considered advanced.

[1] Much of the following discussion reflects the definitions, analyses, and strategic framework of Mark Muro, Jonathan Rothwell, Scott Andes, Kenan Fikri, and Siddharth Kulkarni, "America's Advanced Industries: What They Are, Where They Are, and Why They Matter" (Washington: Brookings Institution, 2015) as well as Mark Muro and others, "America's Advanced Industries: New Trends." (Washington: Brookings Institution, 2016).

[2] For more information on which industries are considered advanced industries, and a complete methodology on selecting those industries, see Muro and others, "America's Advanced Industries."

The 50 Industries That Constitute the Advanced Industries Sector

MANUFACTURING

- Aerospace products and parts
- Agr., construction, and mining machinery
- Aluminum production and processing
- AV equipment
- Basic chemicals
- Clay products
- Commercial & service industry machinery
- Communications equipment
- Computers and peripheral equipment
- Electric lighting equipment
- Electrical equipment
- Engines, turbines, & power trans. equip.
- Foundries
- Household appliances
- Industrial machinery
- Iron, steel, and ferroalloys
- Motor vehicles bodies & trailers
- Motor vehicle parts
- Motor vehicles
- Navigation, measurement, and control instruments
- Other chemical products
- Other electrical equipment and components
- Other general-purpose machinery
- Other misc. manufacturing
- Other nonmetallic mineral products
- Other transportation equipment
- Pesticides, fertilizers, and other agr. chemicals
- Petroleum & coal products
- Pharmaceuticals and medicine
- Railroad rolling stock
- Resins and synthetic rubbers, fibers, and filaments
- Semiconductors and other electronic components
- Ship and boat building
- Medical equipment and supplies
- Reproducing magnetic and optical media

ENERGY

- Electric power generation, trans., and distribution
- Metal ore mining
- Oil & gas extraction

SERVICES

- Architecture & engineering
- Cable and other subscription programming
- Computer systems design
- Data processing and hosting
- Medical and diagnostic laboratories
- Mgmt., scientific, and technical consulting
- Other information services
- Other telecommunications
- Satellite telecommunications
- Scientific research and development
- Software publishers
- Wired & wireless telecommunications carriers

Why do advanced industries matter so much to society and for the broader economy? At the most immediate level, the advanced industries sector has transformed lives.

Working often with university and public-sector laboratories, advanced industries have facilitated the most significant societal breakthroughs and human achievements, from putting a human on the moon to building out the mobile internet for billions of the globe's citizens. Likewise, advanced industries have made useful advances such as GPS and Alexa commonplace, delivered blockbuster biotech drugs, and driven forward revolutions such as "fracking," "cybersecurity" applications, and artificial intelligence that are changing the balance of power in the world. In short, the advanced industries sector looms large in supporting such national and global objectives as national security, energy independence, food sustainability, health, and rising standards of living

But the advanced industries sector also represents a compelling economic and competitive fact. As the leading location of technological development and its application in the United States, advanced industries are in many respects the nation's core sources of prosperity and economic preeminence. Specifically, the advanced industries sector:

- **Encompasses many of the nation's most crucial industries.** Advanced industries embody economic dynamism. As a group these industries determine U.S. economic prosperity and power. For example, advanced industries generate above-average productivity, which is a leading predictor of worker wages. Likewise, because of the complexity of their products, these industries support long supply chains throughout the U.S. economy. That, combined with their high pay, ensures that advanced industries have high employment and output multipliers—measures of the economic activity that one job spurs elsewhere in the economy. Furthermore, nearly every advanced industry resides in the traded

sector—the sector that competes internationally, sells abroad at least partially, and returns revenue to America.

- **Represents a key site of innovative activity.** Related to their orientation toward key national challenges is the fact that advanced industries are the nation's principle locus of industrial innovation. Innovation matters to nations, states, regions, companies, and families because it represents the only viable avenue for high-wage economies to increase productivity and continue to improve their citizens' standard of living. Advanced industries matter inordinately because they draw together society's innovation resources and serve as the primary site of the R&D spending that drives product and process innovation in the economy. What's more, advanced industry innovation investments, activities, and advances "spill over" to other areas as well. They radiate. And in some cases, advanced industry technologies have emerged as "general purpose technologies" that have enabled truly significant productivity advances throughout the economy. This can be seen in areas such as the genomic revolution, the arrival of advanced material science, and emerging new developments in advanced robotics and artificial intelligence.

- **Trains and employs much of the nation's STEM workforce.** The sector also factors significantly in building and maintaining the nation's technical workforce. A storehouse of the nation's STEM knowledge base, the sector also serves as a critical repository of skilled workers. STEM workers matter because they make and apply the inventions that sustain innovation and growth. At the professional level, highly trained engineers and scientists keep American business on the cutting edge through invention and entrepreneurship. At the sub-bachelor's level, skilled technicians produce, install, maintain, and repair the products and machines that allow firms to reach their markets, reduce product defects, create process innovations, and enhance productivity. STEM workers also introduce STEM skills into other industries, including management and professional services, finance, and health care, thus contributing to the retraining and upskilling of workers throughout the rest of the economy. In that sense, the impact of advanced industries again radiates outward through the economy.

Along these lines, the sector—including especially its sizable advanced manufacturing sub-sector—delivers critical, specific, underrecognized value to the nation and its people and places:

- **Employment.** As of 2018, the 50 advanced industries in the United States employed 14 million U.S. workers, or nearly 10% of total employment. Of that, the 35 advanced manufacturing industries contributed 5.7 million jobs and 4% of U.S. employment.

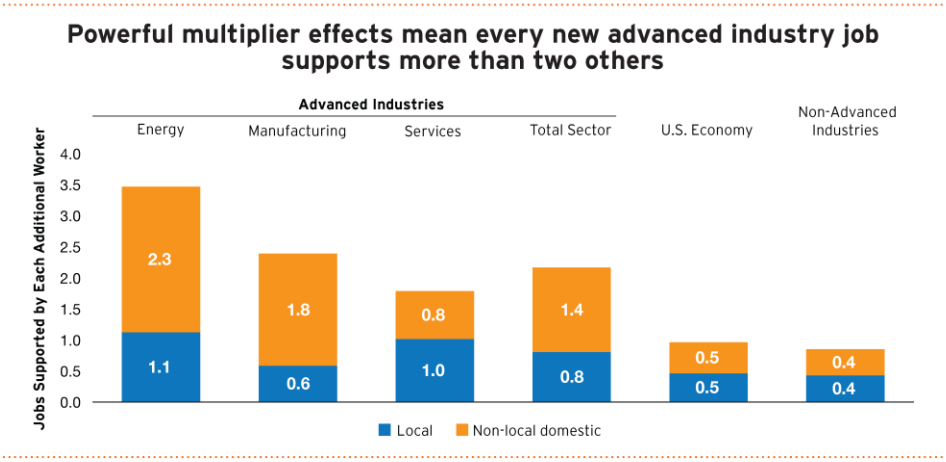
- **GDP.** And yet, even with this relatively modest employment base, U.S. advanced industries generate $3.7 trillion worth of output annually, or 18.5% of U.S. GDP

in 2018. Again, advanced manufacturing was a particularly sizable contributor of $1.4 trillion worth of U.S. output.

- **Productivity.** Workers in advanced industries are extraordinarily productive. Each worker generated approximately $260,000 worth of output compared with $120,000 for the average worker outside advanced industries.[3] For the advanced manufacturing sub-sector the figure is $250,000.

- **Pay.** In 2018, the average advanced industries worker earned $103,000 in total compensation, double the $51,000 earned by the average worker in other sectors. And real absolute earnings in advanced industries grew by 63 percent between 1975 and 2013, compared with just 17 percent for other workers. In advanced manufacturing concerns pay is lower, but still superior to the national average in other sectors at $86,000 annually.

- **Multipliers.** Every new advanced industry job creates 2.2 jobs domestically—0.8 jobs locally and 1.4 jobs outside of the region. For advanced manufacturing the figures are 0.6 local jobs and a hefty 1.8 positions elsewhere. On average in other industries, new jobs create only one additional domestic job—0.4 jobs locally and 0.6 jobs outside the region.



- **Innovation.** Advanced industries perform 90% of all private-sector R&D and develop approximately 82% of all U.S. patents.

Beyond these aggregate contributions, advanced industries have a distinct geography across the U.S. and different industries play a role in different regions. Advanced manufacturing, in particular, plays a significant role in combatting regional inequality, and supporting America's left-behind places in an era of regional divergence driven by

[3] These figures are derived from estimates produced by Emsi Inc.

"winner-take-most" digital technologies.[4] This is because the 35 advanced manufacturing industries are the most prevalent set of advanced industries in the U.S. Heartland, which have, in recent years, been particularly hard hit by the effects of globalization, automation, and deindustrialization.[5] As a result, vibrant advanced manufacturing industries will be particularly important in the coming years to maintaining dignified work in the Midwest and South, mitigating regional inequality, supporting national unity, and enhancing aggregate well-being nationwide.

Together, then, these trends confirm the importance to national wellbeing of both advanced industries in general and especially its advanced manufacturing segment. Without a globally competitive advanced sector it will simply not be possible for the U.S. to maintain its global preeminence, maintain a vibrant national economy, or to restore faith in the nation's promise of success through dignified work in the Heartland.

AMERICA'S ADVANCED INDUSTRIES: WHY THEY NEED SUPPORT, INCLUDING IMPROVED FINANCE

And yet, there is now abundant evidence that the primacy of America's advanced industries, and especially its advanced manufacturing sector, is being aggressively contested—and eroding. In a world of state competition for valuable industries, competitor industries want for themselves the kind of high-value production epitomized by the U.S. advanced industries / advanced manufacturing sector, and so they are competing to build and expand such sectors in their own right.[6]

What's more, these challenges are succeeding—most notably as demonstrated by China's ability, since its accession to the World Trade Organization (WTO) in 2001, to capture leading positions on global economic rankings previously held by the U.S., including total trade, goods exports, and global market share of high-value capital goods.[7] Especially telling is that the U.S. has since 2000 run negative trade balances with both China and the world on advanced technology products, with the deficit continuing to grow.[8]

What do these challenges to U.S. leadership look like operationally? As epitomized by China, competitor nations are accelerating their investments in the key inputs to advanced-sector competitiveness—basic and applied research and development (R&D), STEM worker development, regional supply chain deepening—just as the U.S. commitment has weakened.

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[4] See Clara Hendrickson, Mark Muro, and William Galston, "Countering the Geography of Discontent: Strategies for Left-Behind Places." (Washington: Brookings Institution, 2018).
[5] Mark Muro and others, "The State of the Heartland: Factbook 2018." (Washington and Bentonville: Brookings Institution and Walton Family Foundation, 2018).
[6] Project for Strong Labor Markets and National Development," "Made in China 2025 and the Future of American Industry." (Washington: U.S. Senate Committee on Small Business and Entrepreneurship, 2019).
[7] Project for Strong Labor Markets and National Development, "Made in China 2025."
[8] Christian Zimmermann. "The high-tech trade balance: Importing and exporting U.S. aerospace, nuclear, and weaponry technology." *The FRED Blog.* May 21, 2018.

As a result, the future competitiveness of the U.S. advanced industries sector has become uncertain because the United States is losing ground on important measures of advanced industry competitiveness.

On innovation, for example, the U.S. share of global patenting and R&D is falling much faster than its share of global GDP and population. While the U.S. lost 1.6 percentage points in its share of world population between 1981 and 2016, its shares of global patenting and R&D spending both fell by over 15 percentage points.[9] This indicates that other countries are catching up with, or have surpassed, the U.S. on creating the types of new technologies that generate economic growth, national power, and citizen wellbeing.

Similarly, the United States increasingly lacks the skills base needed to sustain advanced industry competitiveness. For example, the United States ranks a distant 33rd in terms of the percentage of its graduates majoring in STEM fields, with just 17 percent of graduates choosing majors in science, computer science, or engineering.[10] In Germany, meanwhile, nearly 37 percent of university students graduate with such a degree.

And for that matter, Brookings research from a few years ago suggests that that the nation's regional advanced industries ecosystems have been losing supply-chain density to the detriment of manufacturing growth. According to the analysis, the number of the nation's largest 100 metropolitan areas that had at least 10 percent of their workforce in advanced industry employment had dwindled from 59 in 1980 to no more than 23 in this decade—this at a time of rapid Asian ecosystem growth.[11]

But these are just brief instances of the kind of weakened U.S. assertiveness that has eased China's and other nations' moves up the advanced-sector value chain relative to America.

Also essential and more pertinent to today's discussion is the matter of finance.

At a moment when the "Made in China 2025" industrial policy implies direct support to thousands of firms through state funding, low-interest loans, tax breaks, and other subsidies to the tune of hundreds of billions of dollars according to third-party estimates, U.S. advanced manufacturing firms—especially smaller ones—struggle to access affordable capital.[12]

Central to this problem is the fact that, while the United States has the most developed venture capital (VC) system in the world, that system remains difficult to access for

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[9] World Bank, Population total, https://data.worldbank.org/indicator/SP.POP.TOTL; OECD Gross domestic spending on R&D, https://data.oecd.org/rd/gross-domestic-spending-on-r-d.htm; OECD Patents by technology, https://stats.oecd.org/Index.aspx?DataSetCode=PATS_IPC.
[10] OECD, Science, Technology and Industry Scoreboard (2017), https://www.oecd-ilibrary.org/science-and-technology/oecd-science-technology-and-industry-scoreboard-2017_9789264268821-en.
[11] Mark Muro and Siddharth Kulkarni. "Reshoring: Why Its Not Easy." *The Avenue.* Oct. 3, 2014.
[12] James McBride and Andrew Chatzky, "Is `Made in China 2025' a Threat to Global Trade?" (Washington: Council on Foreign Relations, 2019). See also European Union Chamber of Commerce in China, "China Manufacturing 2025: Putting Industrial Policy Ahead of Market Forces." (Beijing: 2017).

manufacturing firms. Specifically, the capital-intensive nature of manufacturing concerns in general, and especially of smaller innovation-oriented manufacturing enterprises, activate thorny market problems that won't likely dissipate on their own.

Most notably, **the natural biases of VC and other capital sources skew the existing small-firm finance system far away from capital-intensive manufacturing enterprises** and are leaving them to face a debilitating lack of access to critical finance in the United States.[13]

In this connection, innovative firms engaged in complex, advanced manufacturing production require greater capital and more time to make a profit than non-production firms.[14] However, a serious market problem intrudes because most existing small-firm finance sources (especially venture capital) default to the low-risk, high-reward nature of digital start-ups and stay away from the longer profit horizons of manufacturing.

"Tech" companies, after all, can produce fast-turnaround, consumer-facing products with little-to-no physical infrastructure. Advanced manufacturing firms, by contrast, require much more time, risk, and capital to develop products, bring them to market, and achieve scale, ensuring they get fewer VC opportunities. Moreover, while advanced manufacturing firms can sometimes locate financing for the earlier stages of their development (e.g. prototyping), they face more difficulty when they seek financing for large-scale production and commercialization. In other words, just as they become consequential, a lack of patient capital undercuts their ability to scale up impact.

In sum, acute capital shortfalls are likely hobbling the ability of smaller advanced manufacturing concerns to grow their operations, contribute to local supply-chain deepening, and enhance U.S. competitiveness, community by community. To the extent smart national policy can nudge more financial support towards advanced manufacturing enterprises, it will address a troubling market problem in America's manufacturing ecosystem and push back against industrial drift.

Policymakers should seek opportunities wherever they can to improve the finance environment for these firms.

AMERICA'S ADVANCED INDUSTRIES AND THE SBIC

The SBIC, meanwhile, offers the ideal tool for this work and should be further enabled to assist advanced manufacturing concerns in the coming years.

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[13] Jonathan Gruber and Simon Johnson, *Jumpstarting America: How Breakthrough Science Can Revive Economic Growth and the American Dream,"*(New York: Public Affairs, 2019).

[14] Elisabeth Reynolds, Hiram Samel, and Joyce Lawrence, "Learning by Building: Complementary Assets and the Migration of Capabilities in U.S. Innovation Firms." MIT Industrial Performance Center Working Paper, March 2013.

The SBIC's current portfolio, in fact, suggests it is well-positioned to invest even more actively in advanced manufacturing. Indeed, roughly a quarter of SBIC financing dollars already go to such concerns already.[15]

With that said, however, the SBIC program as it exists today contends with several limitations that prevent it from investing as helpfully in growth as it might.

First, the lack of sectoral specificity in SBIC loan-making means that public funds are not always channeled toward the highest public benefit—most notably that of advanced industries.

Second, its repayment structure, which begins immediately and is comprised of an SBA annual charge plus interest due semiannually, is not conducive to the nature of the longer-term product development timelines that advanced manufacturing firms require. In general, the SBIC's offerings are not "patient" enough to optimally support advanced manufacturing business models.

So how can SBIC help fill the void? To maximize the program's benefit to U.S. competitiveness through the support of U.S. advanced industries, policymakers should:

- **Explicitly prioritize advanced manufacturing growth in the SBIC's equity capital toolbox.** Currently advanced-sector production enterprises are not specifically mentioned in program policies and criteria. They should be, because as of now they are losing out. Accordingly, the committee should amend the Small Business Act to create within the existing SBIC a program that will offer preferred financing terms to VC firms that invest in advanced manufacturing firms. To determine eligibility for participation in this funding activity. manufacturers' "advanced" status could be confirmed by their location in designated NAICS codes, employing the same definitional methodology and industry list as employed in this testimony. (See the Appendix for a full-list of advanced industries, their NAICS codes, and basic employment and output data).

- **Encourage robust and patient capital in SBIC funding.** Currently the program favors low-risk, high-reward, relatively short-term enterprises, which discriminates against advanced manufacturing concerns. That too should be adjusted because it mitigates against the national interest of expanding the advanced industry sector. Funding, therefore, should be growth-oriented, as much as possible—not time-bound. Changes can include tying repayments to a percentage royalty from sales, as well as denoting full repayment as a multiple of the original loan amount, rather using the current fixed payment-plus-interest model.

Nor is this an over-intrusive case of picking winners. Rather, it is a matter of making the valuable financial supports of the SBIC program available to a sector of national priority

[15] U.S. Small Business Administration, "The Small Business Investment Company (SBIC): Annual Report 2014." Washington.

that cannot now fully access them. Nor are such policies without precedent: Israel, as one example, provides a state guarantee of commercial bank loans to firms, including advanced manufacturing firms, that are aiming to scale-up.[16] Likewise, numerous countries in Europe and Asia have, over the past decade and beyond, pursued active policies that align government, industry, and infrastructure into comprehensive technology-based ecosystems.[17]

In short, the SBA should adopt an ethos of investing in the national interest for the SBIC program.

CONCLUSION

Chairman Rubio, Ranking Member Cardin, members of the committee:

American's medium- and long-term competitiveness and economic prosperity will be determined by success in a few select, but significant, industrial sectors: namely, the nation's advanced manufacturing, energy, and digital industries.

Success or failure there, meanwhile, will be determined by our choices, both what we choose to do and choose not to do, in world of state competition for valuable industries.

Fortunately, one tool for which we can make good choices is the SBA's SBIC program. Given its important role in enterprise finance, it is well worth the time and effort to make sure it is optimized to serve as a tool for national competitiveness.

If rigorously targeted to investment in America's advanced manufacturing sector, it will absolutely help us reassert national competitiveness, support vibrant communities, and promote dignified work.

Thank you again for inviting me. I look forward to discussing these issues with you.

The author would like to thank Rob Maxim, Jacob Whiton, and Anthony Fiano for help with preparing this testimony.

The views expressed in these written remarks are those of the author alone and do not necessarily represent those of the staff, officers, or trustees of the Brookings Institution.

For additional information, including definitional details on advanced industries and extensive federal, state, and metropolitan-area data, see the Brookings Institution report "America's Advanced Industries: What They Are, Where They Are, and Why They Matter" which is here: /www.brookings.edu/research/americas-advanced-industries-what-they-are-where-they-are-and-why-they-matter/

[16] See David Adler, "Financing Advanced Manufacturing: Why VCs Aren't the Answer," *American Affairs*, May 2019.
[17] Gregory Tassey, "Rationales and mechanisms for revitalizing US manufacturing R&D strategies" (National Institute of Standards and Technology, 2010).

Appendix: The 50 Advanced Industries

NAICS Code	Industry Title	R&D per Worker (2009)	STEM worker share (2012)	Jobs (2018)	Output ($mil) (2018)
MANUFACTURING					
3241	Petroleum and Coal Products	$693	41.7%	112,647	$129,117
3251	Basic Chemical	$14,679	50.4%	150,343	$105,122
3252	Resins and Synthetic Rubbers, Fibers, and Filaments	$11,110	46.3%	93,056	$32,143
3253	Pesticide, Fertilizer, and Other Agr. Chemical	$33,109	42.7%	35,691	$18,946
3254	Pharmaceutical and Medicine	$143,110	47.5%	293,219	$135,002
3259	Other Chemical Product and Preparation	$45,778	29.4%	83,936	$18,441
3271	Clay Product and Refractory	$6,308	30.1%	38,920	$4,558
3279	Other Nonmetallic Mineral Product	$4,558	21.9%	79,382	$15,572
3311	Iron and Steel Mills and Ferroalloy	$2,705	29.3%	82,551	$22,638
3313	Alumina and Aluminum Production and Processing	$4,329	32.2%	58,168	$8,146
3315	Foundries	$1,372	36.4%	118,321	$12,773
3331	Agriculture, Construction, and Mining Machinery	$11,709	39.2%	213,618	$33,883
3332	Industrial Machinery	$23,672	50.0%	118,202	$18,941
3333	Commercial and Service Industry Machinery	$13,330	42.2%	91,753	$12,090
3336	Engine, Turbine, and Power Trans. Equipment	$13,557	44.6%	98,055	$17,611
3339	Other General Purpose Machinery	$5,293	41.7%	267,352	$42,431
3341	Computer and Peripheral Equipment	$60,339	71.4%	158,035	$44,214
3342	Communications Equipment	$91,428	57.2%	85,481	$28,218
3343	Audio and Video Equipment	$28,074	32.1%	20,087	$3,602
3344	Semiconductor and Other Electronic Component	$49,612	50.2%	368,535	$87,463
3345	Navigational, Measurement, and Control Instruments	$14,265	57.6%	405,847	$127,902
3346	Magnetic and Optical Media	$5,919	28.4%	13,399	$2,913
3351	Electric Lighting Equipment	$821	27.5%	47,400	$6,158
3352	Household Appliance	$821	27.1%	63,370	$9,757
3353	Electrical Equipment	$821	37.4%	139,757	$18,533
3359	Other Electrical Equipment and Components	$821	37.1%	143,311	$25,842
3361	Motor Vehicles	$48,461	27.1%	232,446	$84,813
3362	Motor Vehicle Bodies and Trailers	$759	22.5%	163,815	$14,397
3363	Motor Vehicle Parts	$6,791	36.0%	596,690	$71,272
3364	Aerospace Product and Parts	$20,501	59.9%	496,520	$129,506
3365	Railroad Rolling Stock	$2,782	32.4%	22,389	$5,022
3366	Ship and Boat Building	$4,640	39.1%	137,052	$14,234
3369	Other Transportation Equipment	$13,476	29.9%	33,844	$8,210
3391	Medical Equipment and Supplies	$24,343	32.7%	314,489	$60,006
3399	Other Miscellaneous	$8,547	23.0%	288,565	$33,140
ENERGY					
2111	Oil and Gas Extraction	$613	58.5%	142,655	$184,951
2122	Metal Ore Mining	$836	47.5%	41,083	$17,785

2211	Electric Power Generation, Trans. and Distribution	$2,173	46.9%	390,778	$257,844
SERVICES					
5112	Software Publishers	$80,977	70.3%	398,679	$193,011
5152	Cable and Other Subscription Programming	$1,370	36.1%	53,534	$46,133
5173	Wired and Wireless Telecommunications Carriers	$455	40.2%	668,476	$317,629
5174	Satellite Telecommunications	$5,948	68.9%	8,673	$1,685
5179	Other Telecommunications	$1,999	57.3%	80,810	$17,683
5182	Data Processing and Hosting	$1,020	56.2%	327,244	$140,905
5191	Other Information	$27,476	40.1%	301,787	$201,645
5413	Architectural, Engineering, and Related	$738	74.1%	1,456,900	$196,319
5415	Computer Systems Design and Related	$7,225	75.0%	2,098,203	$348,818
5416	Mgmt., Scientific, and Technical Consulting	$1,950	38.7%	1,456,802	$219,108
5417	Scientific Research and Development	$13,627	72.8%	679,893	$127,544
6215	Medical and Diagnostic Laboratories	$988	49.8%	273,895	$32,644
	Advanced manufacturing industries	**—**	**—**	**5,666,249**	**$1,402,615**
	Advanced energy industries	**—**	**—**	**574,515**	**$460,580**
	Advanced services industries	**—**	**—**	**7,804,895**	**$1,843,123**
	Advanced Industries total	**—**	**—**	**14,045,659**	**$3,706,317**

Source: Brookings analysis of NSF, BLS, and Emsi data