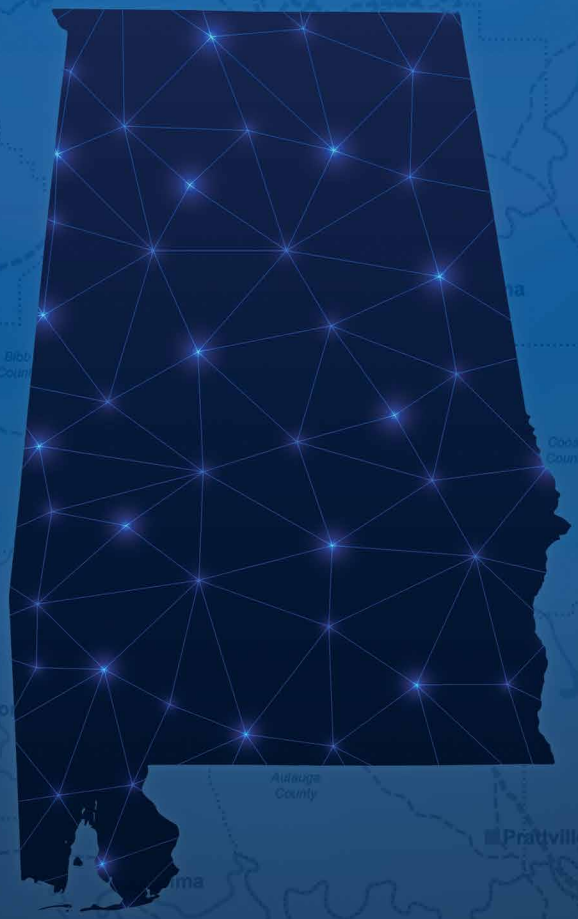
A REPORT BY THE HOOVER INSTITUTION

INNOVATIVE ALABAMA

Prepared for the Alabama Innovation Commission



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3. Supporting Advanced Manufacturing in Alabama

JONATHAN RODDEN

EXECUTIVE SUMMARY

The United States is falling behind competitors like Germany when it comes to labor productivity growth in manufacturing, and the United States has lagged behind in the adoption of advanced manufacturing techniques. In order to compete, American manufacturers will need to innovate. Innovation in the United States, however, has become concentrated in a small number of metro areas and is increasingly disconnected from manufacturing. At the same time, in the wake of the pandemic, bipartisan calls for the "onshoring" of certain manufacturing jobs have increased.

All of this creates an opportunity for Alabama. After having lost a large number of manufacturing jobs prior to 2010, Alabama has seen a robust rebound of manufacturing, both in its larger cities and in nonmetro areas. Much of this manufacturing activity involves new investments and sophisticated techniques, and a sizable share is linked to firms with links to Germany—a country that is at the technological frontier of advanced manufacturing.

This chapter argues that Alabama can solidify its position as one of the most dynamic manufacturing areas in the United States if it continues its efforts to build an infrastructure to support advanced manufacturing along the lines of the German model of collaboration between government agencies, educational institutions, and the private sector. Alabama has already made impressive investments in workforce training, and these efforts should continue to blossom. The next step is to build robust institutions that help bridge what is known as the "valley of death"—the gap between abstract or academic innovations and their commercial application in the marketplace.

Introduction

In recent years, the growth of labor productivity in the United States has been slowing relative to that of its competitors in Europe and Asia. Productivity growth in the United States has largely been driven by its early lead as an innovator in information technology, but productivity growth in other manufacturing activities has slowed to a crawl.[1] This is an important challenge for the United States, since productivity growth, which depends on technical innovation, is an important component of successful global competition and broad-based prosperity.

A loss of competitiveness in manufacturing is especially troubling since this sector has typically produced relatively high wages for a broad cross section of workers. Since US manufacturing firms have found it difficult to compete with the cost advantages of countries like China and Vietnam, hopes for a competitive advantage must be pinned to innovation and increased productivity. However, in recent decades, manufacturing productivity growth rates in the United States are beginning to fall behind those of Germany and Japan.[2]

The importance of regaining American innovation and competitive advantage in manufacturing is a rare area of bipartisan agreement. It was a central area of emphasis for Presidents Obama, Trump, and Biden. In 2020, the costs and national security implications of fragile global supply chains associated with the pandemic were revealed, and strengthening domestic manufacturing and "onshoring" certain types of production have gained a new bipartisan urgency.

In order to be competitive with the countries at the frontier of global manufacturing, US manufacturers cannot rely on cost advantages; they must innovate. They must embrace new technologies like additive manufacturing and others of the so-called Industry 4.0. An important puzzle is that, while the United States is unquestionably the world leader in scientific research and discovery, this has not translated to commensurate advantages in manufacturing innovation. On the contrary, countries like Germany have surpassed the United States in manufacturing innovation and productivity and, as a result, have maintained larger and better-compensated industrial workforces.

If the United States is to regain its competitive advantage in manufacturing, it is quite possible that Alabama will be one of the leaders of that resurgence. While many US states have been experiencing an ongoing loss of manufacturing jobs during the era of globalization, Alabama is one of several states experiencing a rebirth of manufacturing employment, led by the automotive sector.

The key argument of this chapter is that Alabama has an excellent opportunity to build from its existing manufacturing base and become a leader in advanced manufacturing. Notably, much of Alabama's industrial rebirth is based on new investments borne of partnerships with countries already at the global frontier of manufacturing productivity growth. Above all, this chapter pays special attention to the unique partnership that Alabama has forged with Germany over the last two decades. Alabama is in a position to build on German innovations related to workforce training and institutions to promote collaboration between researchers and manufacturers.

This chapter attempts to answer the following question: How can Alabama build on its existing strength as a burgeoning southern manufacturing powerhouse and become a leader in the transition to advanced manufacturing?

If it can do so, the potential benefits to Alabama are substantial. In contrast to software or internet start-ups, which bring small numbers of high-salary jobs that can easily be lured elsewhere, the buildup of a highly competitive advanced manufacturing sector can bring with it high labor productivity, high-paying jobs, and broad-based prosperity. The job-multiplier effect for advanced manufacturing technologies is substantial. One recent study indicates that every technology-intensive manufacturing job supports at least four other jobs.[3]

In fact, Alabama has already started to build a set of institutions to support advanced manufacturing. While low labor costs and tax incentives may have been important components of Alabama's initial appeal to auto producers, Alabama has subsequently invested heavily, and by all accounts successfully, in workforce training. Demands for high-end training are only growing, and further innovation and investment in this area will continue to produce dividends. Above all, this chapter argues that the next step in Alabama's positioning as a hub of advanced manufacturing is to build from Germany's experience in the infrastructure for research and development.

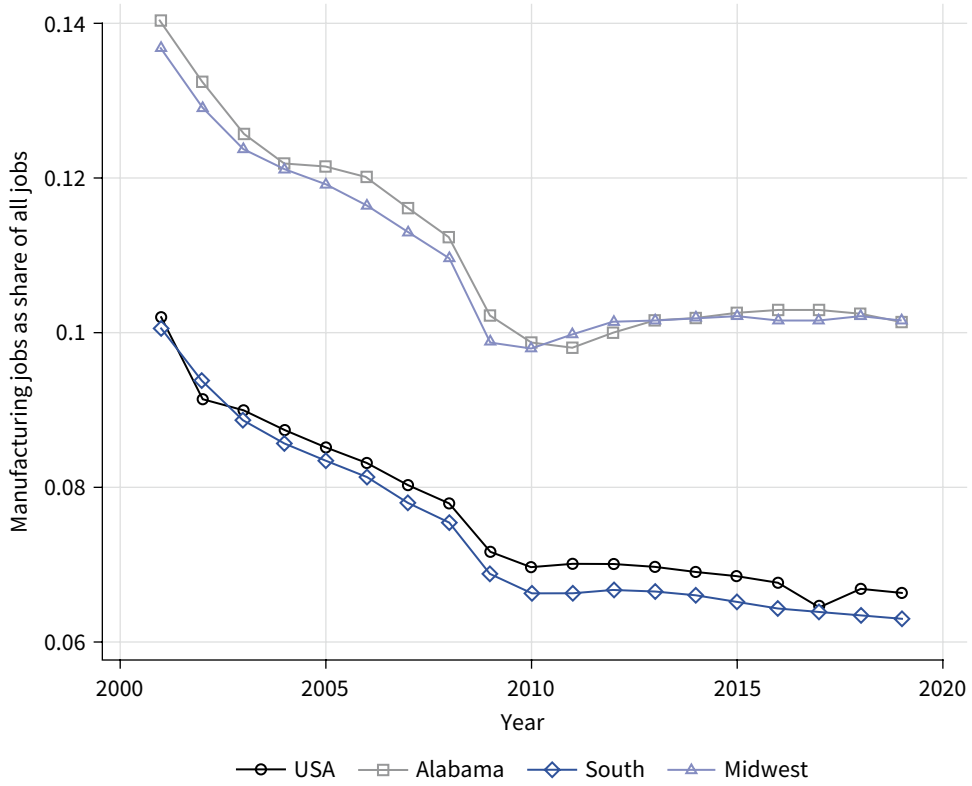
This chapter begins with an overview of the challenges facing manufacturers in Alabama and beyond. I draw on data from a number of sources to paint a picture of the prospects for the development of advanced manufacturing in Alabama. I argue that a crucial weakness in the US system is a long-term decoupling of cutting-edge scientific research from the manufacturing process. There is often a mismatch between the goals of academic researchers at elite universities and those of local manufacturers. I then discuss lessons from Germany and elsewhere in the development of collaborative institutions that facilitate manufacturing-oriented research and development. I discuss Alabama's efforts thus far and consider several possible avenues for further development, concluding with specific recommendations for the Alabama Innovation Commission.

The Current Landscape for Advanced Manufacturing in the United States and Alabama

Considerable attention has been given to the devastating impact of increased global competition on US manufacturing since the 1980s. However, less attention has been paid to the stabilization of job losses and the small, geographically concentrated rebound of US manufacturing that has taken place since its low point around 2010.

Figure 1 displays manufacturing jobs as a share of total jobs in the United States as a whole, in Alabama, in the South as a whole, and in the old industrial heartland of the US Midwest. Manufacturing as a share of employment has fallen precipitously throughout the United States during the era of globalization. However, the free fall of manufacturing jobs stabilized around 2010, and the decline has been much more gradual since then in the United States as a whole, and in the US South as a whole.

Figure 1. Manufacturing jobs as share of total jobs, 2001–2019



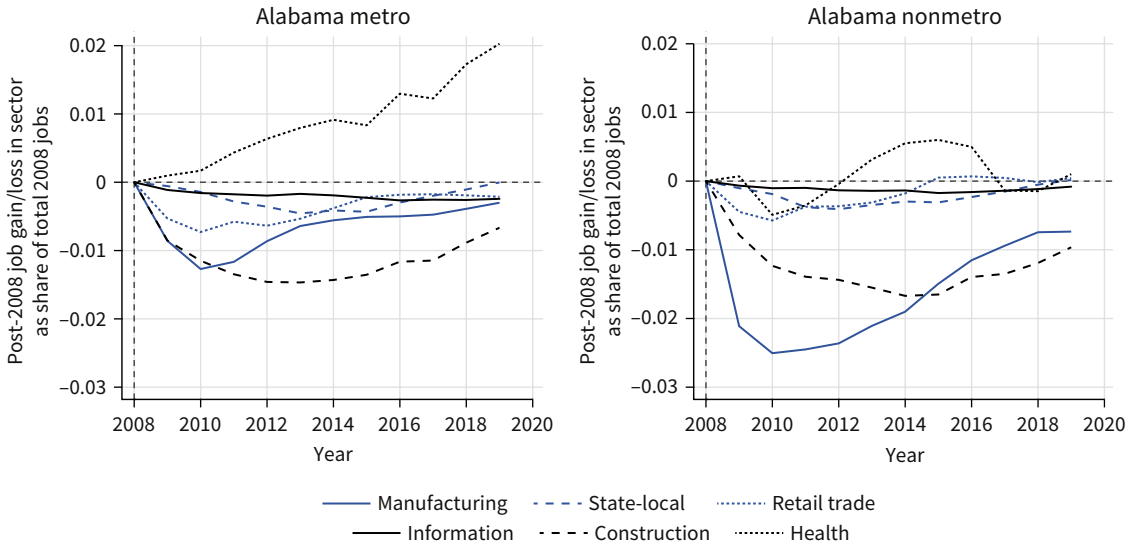
Source: Bureau of Economic Analysis (BEA), Employment by County, accessed from https://www.bea.gov/data/employment/employment-county-metro-and-other-areas.

Manufacturing employment continues to be much higher in Alabama than in the rest of the United States and the South as a whole. Moreover, Alabama is among the small number of US states experiencing a pronounced return of manufacturing jobs since 2011. In this respect, Alabama looks similar to midwestern states like Indiana.

Like many other states, Alabama's recovery from the great recession has been slow. Figure 2 shows that job growth since 2008 has been dominated by the health care sector, especially in Alabama's largest cities. Figure 2 treats 2008 as the base year and examines job gains (or losses) in several of the largest sectors since 2008 as a share of *total* jobs (all sectors) in 2008. This allows us to get a visual understanding of the sectors that contributed most to job losses during the recession, and to the recovery thereafter.

Figure 2 shows that as a share of total jobs, manufacturing and construction were hit harder than any other sector in Alabama. Manufacturing job losses outside Alabama's largest cities were severe. However, figure 2 also shows that manufacturing jobs started a rather impressive recovery in 2010 in both metro and outlying areas, although manufacturing jobs have still not recovered to prerecession levels. The pattern in Alabama is different from that

Figure 2. Alabama's slow recovery from the great recession



Source: BEA, Employment by County.

of some traditional manufacturing states like New York, Pennsylvania, and Illinois, which experienced similar manufacturing job losses during the great recession, but experienced no subsequent recovery.

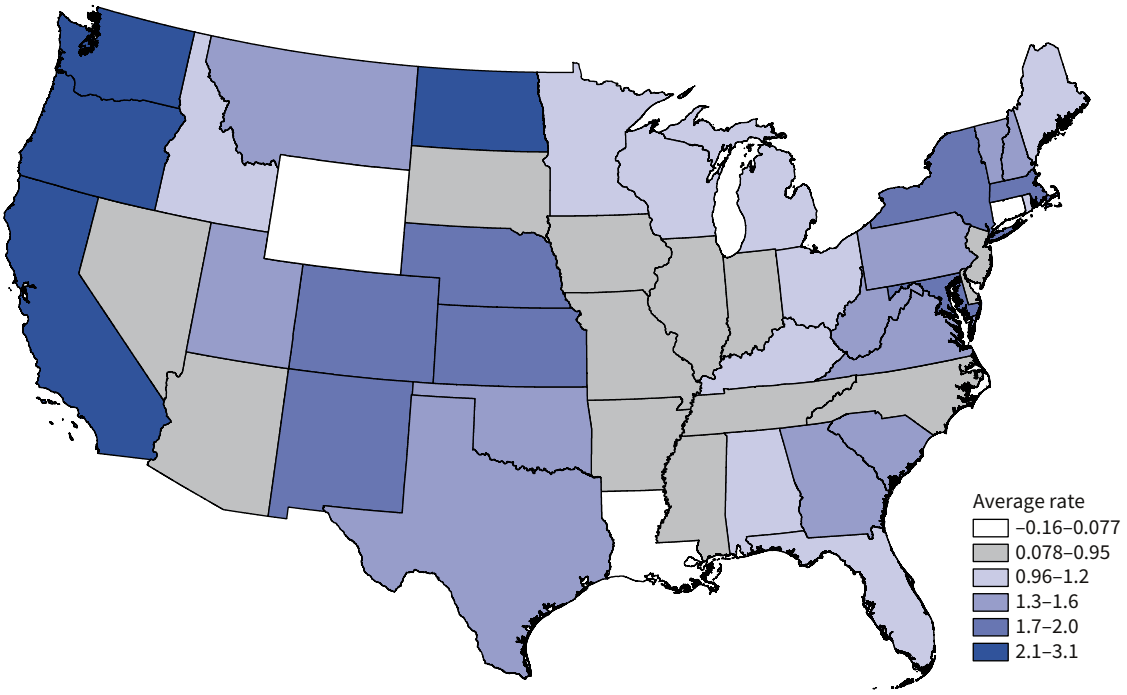
In Alabama, the return of manufacturing is by no means explained by a retreat from globalization. On the contrary, after losing a large number of textile jobs to foreign competition, much of Alabama's industrial rebirth has been driven by partnerships with foreign firms—above all, from Germany, Japan, and South Korea—who have found Alabama to be an ideal location from which to base their North American manufacturing operations.

Alabama is in an excellent position to build on its status as a leader in the revitalization of American manufacturing. Unlike much of the Midwest, a large portion of Alabama's manufacturing infrastructure is new and technologically sophisticated, and Alabama is not burdened with many of the legacy costs associated with manufacturing in the old nineteenth-century manufacturing core of the Northeast and Midwest.

However, Alabama faces many of the same challenges that plague other US regions as they seek to rebuild a modern, competitive manufacturing sector. Above all, the United States lacks some crucial infrastructure for the development of advanced manufacturing. The key claim of this chapter is that Alabama is in a good position to overcome those challenges.

The rate of growth of labor productivity, defined as output per hours worked, has been falling in recent years in several advanced industrial countries. The United States, once a

Figure 3. Average annual growth in labor productivity, US states, 2007–2020

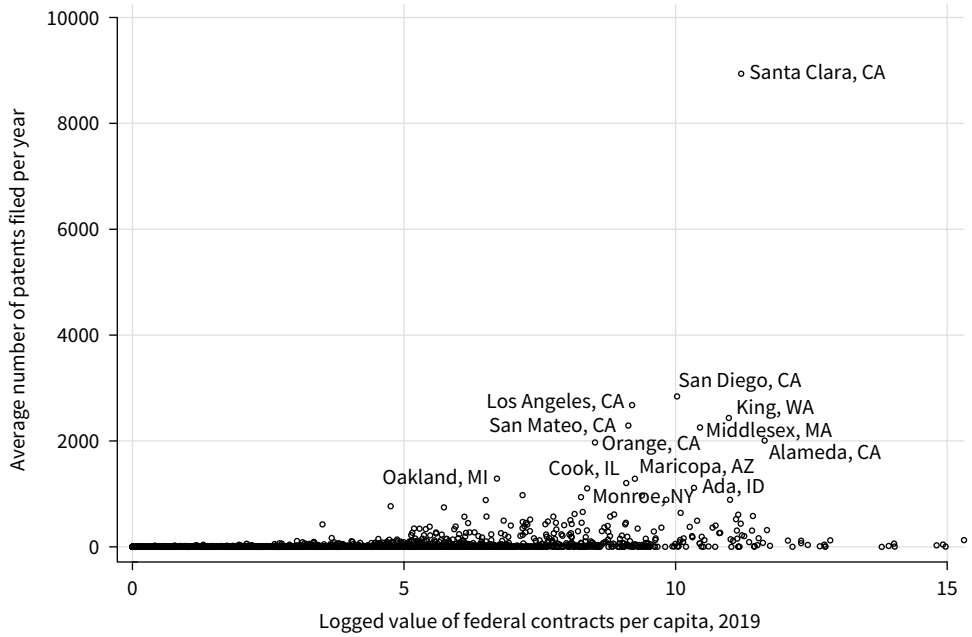


Source: United States Bureau of Labor Statistics, Labor Productivity and Costs, accessed from https://www.bls.gov/lpc/state-productivity.htm.

leader in productivity growth, now demonstrates rates of overall private-sector productivity growth similar to those of Japan and Germany. Moreover, much of the productivity growth in the United States has been driven by the information and communication technology sectors, which have brought immense productivity gains and wealth to highly educated individuals in a relatively small number of cities. However, productivity gains associated with innovations in coastal cities are largely disconnected from American manufacturing. In the period 2004 to 2016, productivity growth in US manufacturing has fallen behind that of both Japan and Germany.[4] Moreover, a large share of US productivity gains is actually driven by the offshoring of the production of computer and electronic products rather than domestic manufacturing.[5]

Figure 3 shows that average annual growth in labor productivity since 2007 has been healthy in the West and parts of New England, but has lagged behind in the manufacturing-oriented states of the Midwest and South. A recent study by the Bureau of Labor Statistics demonstrates that this geographic pattern is driven in part by a strong relationship between information and communication technology as a share of output and productivity growth.[6] With an annual labor productivity growth rate of around 1 percent, Alabama is somewhat below the national average.

Figure 4. Federal contracts and patents, US counties



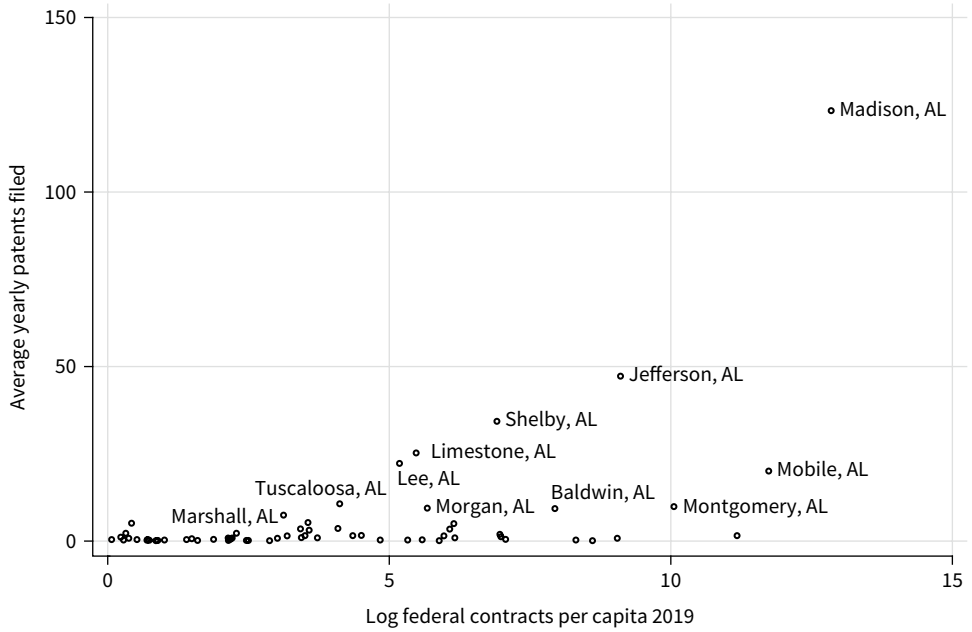
Sources: Data on federal contracts from https://www.usaspending.gov/; patent data from United States Patent and Trademark Office (USPTO), Calendar Year Patent Statistics, accessed from https://www.uspto.gov/web/offices/ac/ido/oeip/taf/reports_cbsa.htm.

Increasing labor productivity is clearly linked to innovation. Many of the states with the highest levels of productivity growth are those that have filed the most patents. An important related fact is that many of these states with innovative knowledge hubs—such as California, Washington, Virginia, and Massachusetts—are also those that have long received especially large flows of federal funding from the Department of Defense. Increasingly, innovation is clustered in knowledge-economy hubs with an ecosystem of universities, federal investment, and start-ups, where relatively little manufacturing takes place.

Figure 4 demonstrates the strong county-level relationship between federal contracts and innovation in the United States, and figure 5 does the same for Alabama. The horizontal axis displays the logged value of all federal contracts in 2019 per capita, and the vertical axis is the average number of patents filed each year since 2000.

The pattern in Alabama is a microcosm of the national pattern. Innovation—at least that which is captured by patents—is relatively concentrated in places with a long history of federal investment in research and development: above all, the Huntsville and Birmingham areas. Although on a much smaller scale than places like Boston or San Francisco, these metro areas have been developing the types of links between industry and universities that facilitate innovation and spin-offs.

Figure 5. Federal contracts and patents, Alabama counties



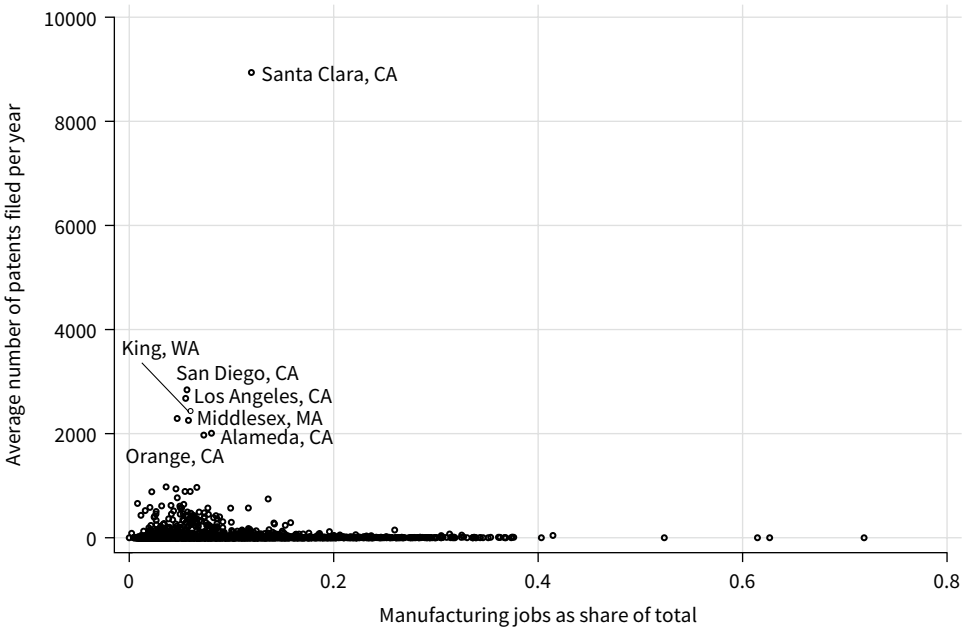
Sources: Data on federal contracts from https://www.usaspending.gov/; patent data from USPTO, Calendar Year Patent Statistics.

While it has made the United States into one of the most innovative countries in the world, there are some potential downsides to this American pattern of geographically concentrated, often federally funded research and development. Above all, this chapter focuses on a growing disconnect between innovation and manufacturing. Figures 6 and 7 display the relationship between average yearly patents and manufacturing as a share of employment, first among all US counties, and then within Alabama.

In the United States as a whole and within Alabama, there is a strong and statistically significant negative county-level relationship between manufacturing and innovation. Rather little innovation takes place in the counties where manufacturing takes place. This can also be visualized in the maps in figure 8: figure 8a displays total county-level patents from 2000 to 2015, and figure 8b shows manufacturing employment as a share of total county population in the 2010 decennial census. Clearly, the geography of innovation and that of manufacturing are quite different in Alabama and the rest of the United States.

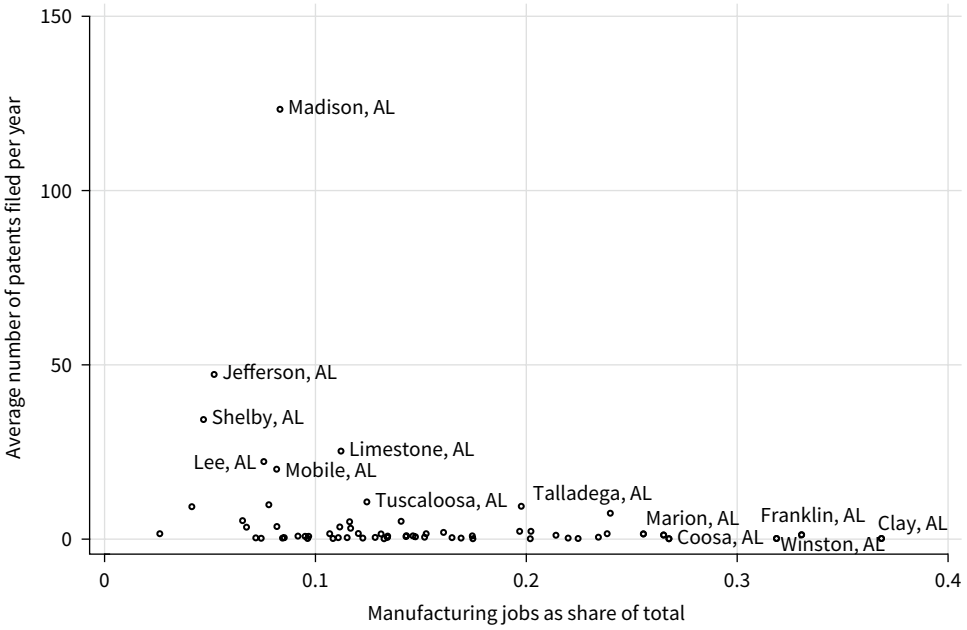
It is tempting to see this disjuncture between manufacturing and innovation as an unfortunate but unavoidable concomitant of deindustrialization, globalization, and the dynamic growth of information technology and the knowledge economy. Indeed, a 2020 study by Autor et al. demonstrates that increasing import competition from China led to less investment in research and development and fewer patents among affected US firms.[7] To state the obvious, increasing foreign competition in the textile industry did not lead to greater innovation in Alabama. Rather, it led to plant closures and deindustrialization.

Figure 6. Manufacturing employment and patents, US counties



Sources: Manufacturing employment data from BEA, Employment by County; patent data from USPTO, Calendar Year Patent Statistics.

Figure 7. Manufacturing employment and patents, Alabama counties

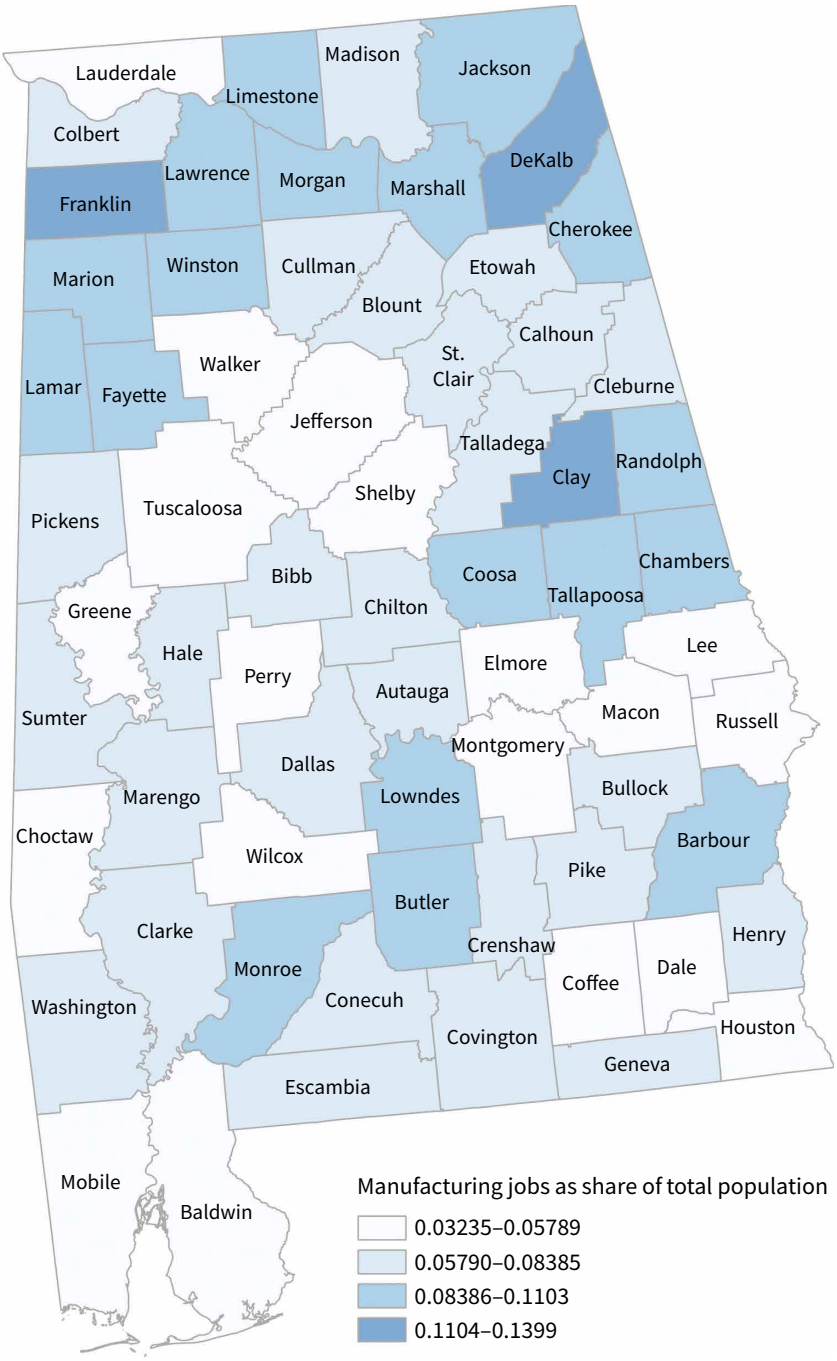


Sources: Manufacturing employment data from BEA, Employment by County; patent data from USPTO, Calendar Year Patent Statistics.

Figure 8a: The geography of patents and manufacturing in Alabama

Source: USPTO, Calendar Year Patent Statistics.

Figure 8b: The geography of patents and manufacturing in Alabama



Source: BEA, Employment by County.

In contrast to the Autor et al. study of US firms, Bloom, Draca, and Van Reenen studied a panel of European firms and found that during the era of dramatically increased Chinese import competition, firms that were most threatened by Chinese imports were *more* likely to innovate.[8] This leads to an interesting puzzle: given the impressive track record of the United States in fostering scientific discovery through its world-class universities and labs, and the associated private-sector innovations in fields like information technology and biotechnology, why did increased competition lead to innovation and resilient manufacturing in places like Germany, but to deindustrialization in the United States? Why is the United States falling behind its peers when it comes to innovation in manufacturing?

The Role of Regional Collaborative Institutions

There is a growing realization that countries at the frontier of advanced manufacturing technology have developed a set of collaborative institutions that foster specialized research and development and advanced workforce training. A basic problem is that a good deal of crucial applied research will not be pursued by individual corporations, which are unable to capture a sufficient share of the benefits of technology platform innovations. This is especially true for technologies that produce significant positive externalities and "proof of concept" research, even for promising new technologies. This type of research often falls into what is sometimes called the valley of death—the gap between abstract or academic innovations and their commercial application in the marketplace. An important component of success in the development of advanced manufacturing is to build institutions to bridge this gap.

Unfortunately, the United States has not been a leader in this regard. It has built an excellent university system, where researchers—often funded by federal grants—seek to make groundbreaking, original scientific discoveries that push out the global frontier of knowledge. This is just as true of researchers at the University of Alabama and Auburn as it is of researchers at MIT and Stanford. In American academia, reputations and careers are built on originality, breakthroughs, grants, and top-tier scientific publications. There are rather weak incentives for researchers to focus on applied research—especially that which is of value to local manufacturing firms. Links between regional manufacturers and academic institutions are surprisingly limited, and the American university system is not designed to bridge the valley of death.

The success of advanced manufacturing in Germany is built on the success of institutions that were designed to overcome this challenge. At the center of the German approach are the Fraunhofer institutes, a set of seventy-four public-private applied research institutions. The Fraunhofer institutes connect universities, large corporations, small and medium-sized enterprises, research organizations, and trade associations. They are organized around specific scientific fields or areas of research. Private and public entities can enter into research contracts with Fraunhofer and gain access to vast collaborative networks and

a wealth of focused expertise. The institutes employ permanent staffs of scientists and technicians, along with experts who rotate through from universities and other institutions.

The institutes preside not only over impressive human capital but also over equipment. Some of them operate pilot manufacturing lines, labs, testing equipment, and demonstration facilities. Some of the equipment is on loan from private firms, which benefit from the collaborative research that takes place at the institute. The institutes also hold a large portfolio of patents that can be accessed by clients.[9] The institutes focus on applied research in a specific area that often corresponds to a cluster of regional private-sector firms, in areas like optics, lasers, wind energy, or automotive research. Funding comes from a mixture of direct government support, contracts with government entities, and private-sector contracts.

These institutions are often built not by the central government, but via partnerships between firms, researchers, and regional and local governments around specific industrial applications. Thus, the government of Alabama, the Innovation Commission, and regional partnerships like the North Alabama Industrial Development Association are well positioned to learn and build from this approach. Perhaps an especially useful example for the Alabama Innovation Commission is the Stuttgart Region Economic Development Corporation, which has built links with Fraunhofer and other research institutes, universities, and the private sector.

It is important to note that Fraunhofer institutes and partnerships like the Stuttgart corporation are not in the business of "picking winners" or attempting to build new industries from scratch. Rather, they focus on sectors that have developed networks and clusters of competence over a period of time, where there are willing private-sector partners that stand to benefit from investments in applied research that are difficult to sustain in-house. The Stuttgart corporation, for example, has developed a series of so-called innovation and competence centers with the goal of driving technological progress to develop the potential of already-established firms.

Current Efforts and Future Opportunity

The German model of support for advanced manufacturing has long been in the sights of US policy makers, but progress has been slow. In recent years, the United States has supported the creation of sixteen institutes sponsored by the Departments of Commerce, Defense, and Energy, cofunded with partners in the private sector. The most recent branding of this network is "Manufacturing USA." These institutes are scattered around the United States, and thus far, no such institute has been created in Alabama. No US region has created anything like the network of competence centers in Stuttgart.

Alabama has been developing a sophisticated automotive manufacturing sector. This is true not only of the large foreign-owned factories, but also of a variety of small and

medium-sized firms that are part of the Alabama automotive supply chain. The demand for greater investment in research and development, and the support necessary for a transition to advanced manufacturing techniques, are clearly growing. The same can also be said of the aerospace sector.

Alabama has already positioned itself as a leader in workforce training. Alabama Industrial Development Training (AIDT), a division of the Alabama Department of Commerce, has developed a nationally recognized program of customized technical training, which takes place in classrooms as well as mobile training units that can be customized for on-site use. Another important resource is Alabama's National Institute of Standards and Technology (NIST) Manufacturing Extension Partnership (MEP), known as the Alabama Technology Network (ATN). Part of the Alabama community college system, ATN links Alabama's industry groups, firms, two-year colleges, and universities around an agenda of training focusing on efficiency and productivity.

Both AIDT and ATN include training that is of use for firms attempting to adopt advanced manufacturing techniques. But for both institutions, the focus is clearly on specific types of training and workforce development rather than on research and development. The Industrial Maintenance and Technology Team at ATN might be a useful institutional partner in any efforts to ramp up a collaborative system of research and development.

Alabama has also made important initial steps to build institutions that can bridge the valley of death described above. For instance, the North Alabama Industrial Development Association facilitates both training and research. An exciting recent development is the construction of the Alabama Robotics Technology Park, whose mission includes not only training but also the development of new robotics systems and technologies. It includes a research and development center that provides space for collaborative research, as well as an outdoor test track.

Another very important development is the recent establishment of the Alabama Initiative on Manufacturing Development and Education (IMaDE) at the College of Engineering at the University of Alabama, which places new focus on manufacturing technology and techniques as well as workforce education. Areas of specialization will include vision and motion detection, materials handling and processing, automated welding, precision measurement, fastening, and automated guided vehicles.

These and related new efforts should be supported, and Alabama should consider additional steps that build on these achievements, with a relatively high level of confidence that well-chosen investments will have a payoff. Alabama is in an especially fortunate position given its links to Germany, which is Alabama's number one source of foreign investment. According to the Alabama Department of Commerce, eighty-two German firms have operations in Alabama, ranging from large corporations like Mercedes and Siemens to a

number of small specialty manufacturers. The Alabama Department of Commerce has even opened an office in Stuttgart.

Given these relationships, Alabama should be in an ideal position to study the German system of innovation and competence centers, paying special attention to Fraunhofer and the network of related institutions in the Stuttgart region. In fact, Fraunhofer has set up institutes in North America, and the Alabama Innovation Commission might revisit the idea of setting up an Alabama Fraunhofer location that is tailor-made for the needs of Alabama's manufacturers.[10] Even if Fraunhofer is not determined to be the right partner, the Alabama Innovation Commission should consider creating a delegation that is tasked with exploring whether there are specific aspects of what might be called the Stuttgart model that can be applied in Alabama.

For example, the commission might explore ways of building on existing universities and nascent collaborative relationships, like IMaDE, to build a homegrown network of competence centers. One possibility is to conduct a careful study to identify the most promising areas for applied research and development—for example, something as broad as additive manufacturing or as narrow as self-driving vehicles—and then build coalitions around the pre-identified sectors or applications.

Alternatively, the commission might consider a model of competitive proposals. As part of this process, applicants could be required to assemble coalitions of firms and researchers and develop a vision for a sustainable collaboration. With this type of model, applicants would also be required to come up with a specified amount of funding that would be combined with state funding.

Challenges

Perhaps the most obvious challenge to creating institutions and collaborations that support advanced manufacturing is funding. Relative to the Stuttgart region or the state of Baden-Wuerttemberg, Alabama is a low-tax environment with a relatively limited budget for this type of institution building. However, it should be pointed out that in the biotechnology sector, Alabama made an initial investment in the HudsonAlpha Institute for Biotechnology, which has clearly paid enormous dividends in northern Alabama.

The funding challenge can also be addressed by taking full advantage of current and future federal programs, including the Manufacturing USA program, aimed at the development of skills and competence centers to promote advanced manufacturing.

A key challenge is to develop procedures that prevent politically connected investments and minimize the probability of pouring public money into white elephants. These dangers are real, but they should not stand in the way of creating effective institutions for workforce

training and applied research. The commission can learn from the experiences, both positive and negative, of similar efforts in Germany, Japan, the United States, and Alabama itself. Competition and transparency must be the guiding principles of a successful process of investment and institution building.

Recommendations for the Alabama Innovation Commission

Ideally, the Alabama Innovation Commission will be able to do the following:

- Mobilize existing links with German firms, researchers, and officials to study the German system of institutional support for advanced manufacturing. Identify institutions and techniques that might be most suitable for Alabama.

- Work with firms (including small and medium-sized firms) and researchers to identify the most pressing needs for workforce development and applied manufacturing research and development.

- Explore ways to ramp up existing efforts at workforce development and research and development and, if necessary, improve the responsiveness to the needs of Alabama's existing manufacturers.

- Continue to support efforts like Alabama IMaDE and explore ways of using existing partnerships to build a robust system of support not only for training but also for innovative research and development.

- Consider the development of a competitive system in which coalitions of firms and researchers apply for cofinancing from the state for jointly funded competence or innovation centers.

NOTES

The author wishes to thank Arndt Siepmann for a helpful conversation during the development of this chapter.

1 Martin Neil Baily, Barry Bosworth, and Siddhi Doshi, *Productivity Comparisons: Lessons from Japan, the United States, and Germany* (Washington, DC: Brookings Institution, 2020), 11, available at https://www.brookings.edu/wp-content/uploads/2020/01/ES-1.30.20-BailyBosworthDoshi.pdf.

2 Baily, Bosworth, and Doshi, *Productivity Comparisons*.

3 Deloitte Touche Tohmatsu, *Advanced Technologies Initiative: Manufacturing and Innovation* (New York, 2015), available at https://www2.deloitte.com/content/dam/Deloitte/us/Documents/manufacturing/us-indprod-deloitte-and-council-on-competitiveness-advanced-tech-report.pdf.

4 Baily, Bosworth, and Doshi, *Productivity Comparisons*, figure 6.

5 Susan Houseman, Christopher Kurz, Paul Lengermann, and Benjamin Mandel, "Offshoring Bias in U.S. Manufacturing," *Journal of Economic Perspectives* 25, no. 2 (2011): 111–32.

6 "Monthly Labor Review," US Bureau of Labor Statistics, June 2019, https://www.bls.gov/opub/mlr/2019/article/bls-publishes-experimental-state-level-labor-productivity-measures.htm.

7 David Autor, David Dorn, Gordon H. Hanson, Gary Pisano, and Pian Shu, "Foreign Competition and Domestic Innovation: Evidence from US Patents," *American Economic Review Insights* 2, no. 3 (2020): 357–74.

8 Nicholas Bloom, Mirko Draca, and John Van Reenen, "Trade Induced Technical Change? The Impact of Chinese Imports on Innovation, IT and Productivity," *Review of Economic Studies* 83, no. 1 (2016): 87–117.

9 National Research Council, *21st Century Manufacturing: The Role of the Manufacturing Extension Partnership Program* (Washington, DC: National Academic Press, 2013).

10 It is my understanding that the idea of building a "Fraunhofer Alabama" has been discussed in the past without proceeding very far.

About the Author

Jonathan Rodden is professor of political science at Stanford University and senior fellow at the Hoover Institution and the Stanford Institute for Economic Policy Research. He received his PhD at Yale University and was previously the Ford Professor of Political Science at MIT and a Fulbright Fellow at the University of Leipzig, Germany. He has written extensively on federalism and fiscal decentralization, and has worked with the IMF, World Bank, USAID, and the European Parliament on related issues.