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Robert N. McGrath
Embry-Riddle Aeronautical University - Daytona Beach

Saad Laragui
Embry-Riddle Aeronautical University - Daytona Beach

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The Competitive Advantage of Florida Firms in Aerospace

Robert N. McGrath and Saad Laraqui
Department of Business Administration
Embry-Riddle Aeronautical University
600 S. Clyde Morris Blvd.
Daytona Beach, Florida 3211-3900
(386) 226-6703
mcgrathr@cts.db.erau.edu

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Abstract

This paper provides an analysis of the sustainable competitive advantage of Florida firms as they compete in the aviation/aerospace sector, with special emphasis on the space industry. First, the theory of comparative advantage is reviewed, as well as its relevance to the theory of firm-level competitive advantage. Next, after a brief review of local history, recent actions taken by Florida policy makers will be reviewed to serve as "grist for the mill" of economic theory. Florida's actions in light of theory will then be framed and implications offered.

Introduction: Comparative Advantage

In 1776, Adam Smith wrote the *Wealth of Nations*, which presented a philosophy that has become a mainstay of modern economic thought. As an argument against mercantilism, he asserted that nations should invest their resources into producing goods that, because of natural endowments, can be produced efficiently. This is still the basis of free-trade philosophy, and referred to as comparative advantage.

More specifically, the theory of comparative advantage suggests that a country should specialize in the production of those goods it produces most efficiently, and that goods that it produces less efficiently should be bought from other countries, even if it produces these goods more efficiently than the country from which they are bought [1.]

A country may be more efficient, or in other words, have an *absolute advantage*, in producing a number of goods as compared to another country. However, this efficiency would vary with the different products. As a result, the country would have a *comparative advantage* in producing those products in which it has a higher absolute advantage, over those that pose a lower absolute advantage. In light of this, the combined total production if the comparative advantages is higher than it would be if all these products were produced in the same country where they were consumed. In essence, when two countries engage in trade, they can increase their combined production of the products being traded and consumers in both countries can consume more of these goods.

Strategic Management theory is concerned with how firms compete, and how managers can achieve sustainable competitive advantage vis-à-vis rival firms [2.] On a global scale, of course, competition across borders is now rampant. Yet economic conditions are not homogenous worldwide, and comparative advantage still exists in many places and in many forms.

While much of the discussion infers that the political borders of nations bound comparative advantage, it is more correct to focus on economic regions. A relevant economic region can be bounded by the nation, of course, but sometimes multi-nation regions are the right perspective, and sometimes within-nation regions are the right perspective. Given the readership of this paper, it will view Florida as an economic region, within which firms vie to use its comparative advantages in aviation/aerospace to achieve global competitive advantage.

Competitive Advantage

In 1990 Michael Porter published his theory of international competitive advantage that has become the most popular framework for diagnosing why firms succeed or fail, as a function of where they are located [3]. A summary of the theory and its implications follows.

Porter's research question was, given the limitations of existing theories to diagnose advanced and complicated industries, what is it about a firm's location that can be a source of sustainable competitive advantage? Here, competitive advantage was defined as a firm's ability to earn above-average profits over time. His research found that though there are many reasons, they can be summarized in terms of four major factors that can thought of as a "dynamic diamond."

The Dynamic Diamond. The first corner of the diamond is Factor Conditions. Economists study industry in terms of factors of production such as land, labor and capital. "Land" refers to all basic material resources - their abundance, quality, accessibility, and cost - and also climate, location, and so forth. "Labor" refers to human resources – the quality, skill level and cost of labor - and also national culture, work ethic, and the like. "Capital" refers to money, and firms need access to money in order to invest in the future. But it also refers to the cost of that capital, as firms must produce revenues in excess of all costs in order to survive. Therefore capital involves the whole financial system that affects the business climate of risk versus return. To the traditional list of factors, Porter added "Infrastructure," referring to the quality of transportation and communications systems, ease of making all sorts of business transfers and deliveries, and even housing and cultural factors.

The above factors could be more simply categorized as being basic or advanced, and generalized or specialized. Basic factors might be thought of those that are naturally endowed, such as raw resources, climate, and location. Advanced factors might be thought of as those that are created, such as educational systems, communications systems, and efficient financial markets. Generalized factors may be thought of as those that can be used across industries, such as financial markets. Specialized factors are those specific to a particular industry, such as a unique base of scientific/engineering knowledge.

Porter found that an important source of sustainable competitive advantage is the presence of advanced, specialized factors. While specialized factors are riskier investments than generalized factors, their very rareness gives them potential that is not easily copied. Similarly, while basic factors can be the source of low-cost advantage, low-cost is a strategy that can usually be imitated. Advanced factors are more the source of value-addition through differentiation, a more defensible strategic intent.

The second corner of the diamond is Demand Conditions. Competitive advantage generally is found where local demand conditions are so tough that competing firms are forced to continuously upgrade, just to survive locally. The ability to survive in a tough local market confers an obvious ability to compete well internationally. The local market should be the most sophisticated in the world, and if scale economies are present in the industry, local demand should be proportionately large. Localness comes into play in the sense that physical closeness amongst firms makes joint developments more flexible, especially in industrial markets. Also, the market being assumed is one that is "ahead" of markets elsewhere in terms of being able to anticipate global demand. And where the rate of growth of technology is relatively fast, being in the middle of it can confer an advantage. Also influential is the kind of firm. The presence of locally-owned multinational firms can create "pull" in foreign markets, and the presence of alien-owned multinational firms can create an widespread emulation of local ways of doing business.

The third corner in the diamond is Related and Supporting Industries. Competitive advantage in one industry can be linked to competitive advantage in other industries. For example, a world-class supplier base can affect the cost, quality, deliverability etc. of advanced factor inputs such as components and systems. Supplier industries can also be the real locus of technological innovation and upgrading, especially where suppliers and buyers are more or less co-located and can establish tight relationships. Proximity also affects transportation costs, but less obvious is that it also affects the ability to transfer information. Related industries (other than suppliers) can be the source of technological interdependency, spillover, and pull-through effects. The greater the complexity and number of related industries, the greater the potential for competitive advantage because complexity is very difficult and costly to copy.

The fourth corner of the diamond is Firm Strategy, Structure and Rivalry. Ultimately, it is not industries that compete, nor it is nations or states that compete. The basis of competition is between firms - industry, economic region and nation are contexts. Most people understand the basics of competition, but some of the driving forces are subtle. For example, a company's ownership structure has much to do with its strategic goals. Stockholders, for example, are interested in seeing high economic gains to their investments; state-owned firms are driven by more political and social forces. The result has much to do with evaluations of risk, return, and investment decisions. Local conditions can also create powerful perceptions as to the national priority of an industry, and the related history of a locality is virtually impossible to replicate.

Evolution. Porter noted patterns in the evolution of national competitive advantage that he summarized in four phases. Of course, not all industries go through all four phases, and some industries stay "stuck" in one phase without advancing to the next. The first phase is the Factor-Driven phase. Often, the initial development of competitive advantage is anchored in factor conditions. Competitive advantage can be found through a local abundance of an otherwise scarce, highly-demanded resource; simply a "matter of supply and demand." The trouble with this strategy is its vulnerability to changes in demand, or the ability for firms elsewhere to "invent around" their disadvantages.

The next phase is the Investment-Driven Phase. Regions wishing to industrialize beyond a dependence on natural resources need massive, dedicated and long-term investments from governments and industry in order to "come up to par" in specified industries. In this phase, competitive advantage is typically sought through strategies that emphasize large market share, large production volumes, and economies of scale and learning that drive down costs. But a pure low-cost advantage is always vulnerable. It can eventually be copied or invented around, or revolutions in technologies can redefine an industry and render a dependence on scale indefensible.

The next phase is the Innovation-Driven Phase. In this phase all corners of the diamond are structured for high performance and synergistic value-addition. The ultimate source of competitive advantage is constant innovation and upgrading. Sophisticated demand and a competitive environment relentlessly pull firms in all related industries to do their best.

The fourth phase is the Wealth-Driven phase, and is something of a decline stage. Some economies, or at least some industries, seem to create value not through innovation, but by the redistribution of existing wealth. Or sometimes societies change their cultural attitudes about competition and lose their competitive spirit, relying on industries that don't really create wealth. The result can be a loss of advantage, at least relative advantage.

Strategies. On the corporate side, managers should understand that there are no quick fixes to economic conditions. Yet they should also understand that economic conditions are not entirely "out there:" their actions and strategies play, at least in aggregate, significant roles in shaping conditions. Managers should not be afraid to target the toughest market segments and competitors, if they want to compete globally with advantage. Relentless improvement is, in and of itself, a source of sustainability. All factors in the diamond should be the object of continuous improvement and innovation. This applies to the entire value-adding system; systems are very difficult to build, but once they exist, they are extremely difficult and costly to imitate or invent around.

On the governmental side, the emphasis should be on enhancing competitiveness by providing the resources with which to compete, and fostering world-class levels of competition. Again, firms compete for competitive advantage, not regions, economies or nations, but governments play vital roles in shaping conditions. Competitive advantage is always relative, and a dynamic view should prevail. This dynamism should be focused on upgrading of all factors in the diamond. Also, it is sometimes the case that arbitrary categorizations of industries impede progress. Calling an industry "mature," for example, can create perceptions that are blind to opportunities for rejuvenation. The economic benefits of competition will have casualties, but the winners will be world-class and more wealth creating.

Government's impact on education and training can be critical to the process. Here it is important for forms of higher education/training, other than colleges and universities, to exist. Such forms should be structured around tight industry relationships, and significant levels of corporate training may be needed.

Science and technology policy should be carefully aligned with an understanding of the dynamics expressed here. For example, a careful balance should be struck between firm-level research and cooperative efforts such as consortia. Also, research tends to be better done in research universities than government labs, but should have strong connections to industry, with clear goals and contracts.

Governments must nurture world class infrastructures, especially in transportation and communication. Government policy also impacts the availability of low-cost investment capital, and the financial infrastructure that sees to its efficient allocation. Also, deficit spending can be a viable form of investment, in the same sense that businesses need to borrow in order to finance new ventures. Finally,

governments play an important role in "signaling." Through both word and action, governments announce to the world patterns of activity that are closely monitored.

History

Obviously, a great deal of time can be consumed developing competitive advantage in advanced industries. Therefore history is important to review in an analysis.

From the early 40s to the present, Florida has played a vital role in the development and growth of the United States' space industry [4.] The origins of Florida's involvement can be traced to the Second World War, when it was chosen as a military training ground. The millions of federal dollars that flowed into the state triggered a boom in industries like shipbuilding and weapons manufacturing, and helped Florida's economy grow past a dependence on agriculture and tourism.

Being the southeastern tip of the nation, Florida's geography was important to the national defense. The Banana River Naval Air Station was activated in 1940 in Brevard County, as a base for sea-patrol and anti-submarine airplanes. Declared surplus in 1947, this station was handed over to the Department of the Air Force, which subsequently renamed it Patrick Air Force Base in 1950 and used it as the East Coast Headquarters for US missile operations.

By 1950, Florida had become the fastest growing economy in the US with tourism, agriculture, forestry and construction being its main industries. Florida was now home to the principal eastern missile launch site for the US, with the establishment of the Cape Canaveral Air Force Station just north of Patrick AFB. The Florida Missile Test Range provided a proving ground for early guided missiles.

Florida grew in importance as a venue for testing and launch facilities. However, the launch pads at Cape Canaveral faced impending obsolescence because of quantum advances in missile design. In response, Governor LeRoy Collins provided an additional 11,728 acres at the Cape Canaveral establishment in 1955, which allowed the creation of several new launch complexes. Florida's first space commission, the Nuclear and Space Commission, was established in 1957 to promote education and research relative to nuclear and aerospace development, and to attract new industries based on nuclear and aerospace science and engineering.

In 1958, the National Aeronautics and Space Administration (NASA) was created for civilian control of outer space exploration efforts. In January of the same year, the free world's first satellite was launched in response to the Soviet launch of Sputnik.

In 1960, the population of Florida was almost twice as much it was a decade prior, and Florida had become the fastest growing state. With agriculture and tourism, the aerospace industry was also growing. By virtue of its location at Merritt Island, NASA's space launch complex had cemented Florida's position in space exploration, associated research and development, and stimulated growth of the industries in its vicinity.

The Apollo program lured companies like Pan American World Services, McDonnell Douglas and Martin Marietta to locate operations in Florida. In 1969, Florida was chosen over locations in Texas, California, Georgia, Hawaii, and islands in the Caribbean as the location for the Space Shuttle program, annual expenses for which were estimated at $4 - 5.7 billion.

In 1970, Florida was ranked the ninth most populous state, with service related industries showing employment levels well above the national average. But with Vietnam highlighting defense issues, the legislative focus slipped away from space exploration. Moreover, a recession slowed down Florida's aerospace industry. This was despite NASA's plans to construct a Space Shuttle prototype, and a strong endorsement by the President in 1971. Despite all these problems, in 1976, a joint program for technical assistance to Florida manufacturers, called the Southern Technology Applications Center (STAC), was setup among NASA, the State Board of Regents, and the Florida Department of Commerce.

In 1980, Florida was the seventh largest state in the nation. By 1986, the state topped the southeast region and ranked sixth in the nation in terms of employment in high-tech industries. In May 1987, Governor Bob Martinez created the Governor's Commission on Space, in light of growing demand

for commercial launch capabilities, the need to lower launch costs, improve the reliability of satellites, and develop unmanned expendable launch vehicles. Annual industry revenues were forecast to reach $60 billion by 2000.

Repositioning Florida's Comparative Advantage

In 1999, the Florida Legislature convened the Commission on the Future of Aeronautics and Space in Florida, to study and make recommendations about how the State could improve its position in the aviation and aerospace industries [5]. This section summarizes the commission's observations and recommendations. It should be noted that while the State was in an advantageous situation overall, the commission was mostly concerned with noting opportunities for improvement.

While Florida's legal environment was noted as positive, relative changes between Florida and other locales did not altogether suggest an improvement in Florida's situation. It was noted, for example, that because of unwieldy bureaucratic processes, making significant improvements to aviation facilities could take up to ten years. This is particularly applicable to airport planning and development. This could be reduced through state action and streamlining of processes. Doing this could actually bolster Florida's advantage relative to other areas, most of which tended to suffer the same trend.

In related fashion, construction standards for T-hangars (the basic shelter for general aviation aircraft) varied greatly among the State's 67 counties, making coordination difficult and resulting in waiting lists for the general aviation consumer population. This was an area that could be rectified through political leadership, bolstering the already enormous popularity of general aviation in the State.

The expansion of existing businesses was also problematic because of lengthy and expensive permit processes. This situation was exacerbated by the fact that market conditions were known to change rather quickly, frustrating equally rapid responses from industry. Again, a statutory solution seemed feasible.

At Cape Canaveral, recent policy changes had made the role of the Spaceport Management Council confused, at least in terms of its interfaces and relationships with government at the federal and State levels. Here the State, at least, could take assertive and constructive action.

Because of the Department of Defense downsizing felt throughout the 1990s, Florida was still hurting. There had always been many military installations in the state and some major ones were still scheduled to be shut down. Political opposition to future injury to local economies could be organized and sustained.

The commission next considered simple ways of attracting business into the state. One serious problem was that 70% of industry executives rated the availability of skilled labor in Florida as being poor, and about the same percentage felt that the public schools were poor. While this situation was systemic on a national scale, one idea that emerged to help make local improvements was the development of a Space Technician Certification, noting that present practises provided little more than on-the-job training in this type of job. If local educational institutions could develop a credible certification standard and training program, Florida could produce most of the qualified people who entered the space industry in many technical fields.

Key to the industry in the State was the existence of one of the nation's strongest infrastructures for training pilots for all aspects of aviation. Growth was limited, however, by factors such as airport overcrowding, aircraft noise, infrastructure (technology) limitations, joint military use, and of course safety concerns. One idea to stimulate growth was to provide tax relief for the development of flight simulation technologies in the state. Another was the development of Centers of Excellence in three main areas: the training of maintenance technicians, airline crew training centers, and space research and education.

From the marketing standpoint, highly professional and intense multimedia advertising of the State's advantages as a business location, similar provisioning of web-based information, a system of

business to business networking and mentoring, and various incentive packages for manufacturers were also recommended to stimulate growth.

Additional governmental contributions could be made in areas such as modifications to the aviation fuel tax, a constitutional revision affecting the taxation of industrial land, business eligibility for tax exemptions, and modifications to worker compensation statutes.

Next, it was noted that venture capital had increased significantly in the State in recent years, but that the growth rate was only about half the national average. Also, and despite the very strong presence of NASA, the State ranked 30th in the attraction of NASA funding to businesses. These factors bade poorly, considering what seemed to be a definite shift towards the development of a national movement towards national space transportation.

In terms of infrastructure, Florida's needs were going partly unfulfilled. Ageing facilities inferred the need for a $10 billion investment in ten years. This was seen to be critical, as the nature of business advantage was noted as shifting from an emphasis on production location, to an emphasis on distribution location (noting Florida's key positioning in the latter.) In conjunction, the establishment of multi-modal transportation infrastructures was needed, as were improved standards for efficient freight/cargo transportation. Finally, Florida's energy costs were about 32% higher than nearby states, a definite disincentive for business.

The commission next considered ways to improve scheduled airline service. The airlines were a key link to the tourist industry, and critical to the state's economy. Interestingly, it seemed that market dynamics were serving Florida well, in terms of matching supply with demand at gross levels of analysis. Intrastate, interstate, and international patterns were healthy. A healthy general aviation climate was an important adjunct. At more refined levels, however, some airports were thriving while others were suffering dropping demand. However, lack of meaningful metrics for evaluating the level of service an airport truly provides precluded any strong recommendations, so market forces were again stressed as the most likely, thought sometimes painful, solution.

The commission next considered the Aerospace sector. Envisioned in this arena were the advent of aviation-to-space transportation, the integration of air and space traffic controls, and across-the-board advancements in information-based technologies. Of particular interest was the Small Airplane Transportation System, NASA's vision for the future of personal and family transport. In short, NASA was determined to make the airplane the transportation mode of choice for trip lengths that were a little too long for autos, but a little too short for airline transport. Florida's environment fit well in this vision, and strong coalitions of business, academia and government had been formed in the state to make it a technology and concept testbed. Consequent developments in the state's aviation infrastructure, airplane manufacturing base, and aviation information technology manufacturing base could bring Florida many jobs and millions of dollars.

The space industry, perhaps the crown jewel of Florida's industrial base, was noted as being in need of rejuvenation. Existing launch technologies needed to come down dramatically in costs in order to support civilian applications. The Space Shuttle was intended to be a first-generation reusable vehicle, and no second-generation concept was at any advanced stage of development. Many reusable launch vehicle concepts were early in development, however, and related R&D would need massive amounts of funds, public and private. Florida's "Space Coast" stood much to gain, in addition to the sound manufacturing presence throughout the state by key aerospace firms.

Also, NASA's role at Cape Canaveral was being redefined, and was in the process of returning to a technology development organization, while turning over operational concerns to industry. Finally, the facilities at Cape Canaveral were also in need of modernization, which would channel many more millions of dollars to contractors.

Ironically, however, Florida ranked 30th among the United States in terms of its ability to attract federal funding for research and development. A number of initiatives for state involvement in changing that picture were presented.

Finally, the commission considered education, starting with the observation that there was a critical shortage of educationally qualified workers. In fact, a consensus among executives was that

finding, qualifying and maintaining a workforce was the number one challenge they faced as they conducted business in Florida. The educational component of that pointed to both secondary and postsecondary levels, and especially in math, engineering, and computer science.

Ideas for improvement included providing better financial incentives for teachers in math and science, and establishing global education outreach programs to attract talent from other countries. But Florida ranked 30th among the United States in terms of teachers' salaries, and the need for 160,000 new teachers in the upcoming decade was predicted.

Other ideas included developing interesting curricula in aviation and aerospace, an aviation/aerospace magnet school program, expansion of scholarship programs, and career awareness campaigns.

On the other hand, research capabilities at Florida's Universities were strong. Partnerships with these key institutions would help determine the fate of many of the initiatives described above, especially the more visionary aerospace ones.

Again, this section reviewed a commission's findings as of the late 1990's. Assuming these conditions did not changed radically since, the following section reconstructs the situation according to Porter's framework, and notes a few of the stronger implications.

Discussion and Conclusion

Based only on the theory and facts reviewed, this section addresses the question: does Florida have the kind of comparative advantage(s) in aerospace that local firms can exploit for sustainable competitive advantage? The modest hope is not to be authoritative, but merely to stimulate constructive, ongoing conversation.

Referring to the dynamic diamond, there are positive and negative features of local Florida dynamics. In terms of factor conditions, Florida is blessed with excellent climate, location, and an abundance of good geographical conditions for aerospace. Policy makers recognize the importance of the industry and are actively involved in fostering a healthy climate for business. Issues of taxation and cumbersome bureaucracy are being addressed, and sore spots like the level of NASA's local investment, the rate of business formation, and the availability of investment capital have been noted. An acute problem, however, is the scarceness of a local labor pool appropriate to the skills needed by the industry. Higher education seems up to the task, but local primary education needs much upgrading. Overall, theory suggests that factor-based advantage exists but without upgrading in the advanced factors, and investments in industry-specific factors, Florida firms are vulnerable to losing present advantage.

Demand conditions are difficult to distinguish, local v. global. The airline industry is very global, for example, and services provided at Cape Canaveral benefit everyone more or less equally, at least eventually. This is a favorable condition, but no more so than can be found in some other economic regions. An extremely favorable condition is the clustering effect of the Space Coast, populated by locally-based, multinational corporations. This clustering, especially so proximate to the massive launch capacity/infrastructure, exists in very few other regions in the world, and is a vital economic resource.

It is an oversimplification, but there may be a dichotomy concerning related and supporting industries. The strength of the aviation industry (a related industry) in Florida has many economic and cultural spillover effects which benefit aerospace. However, while the presence of major system integrators is very strong in Florida, its manufacturing (supplier) base is less strong *locally*. But this observation is unnecessarily "academic." Here it may be irrelevant to view Florida as the economic region in question, as the scale of this manufacturing base practically necessitates a national, if not global, view.

Firm strategy, structure and rivalry are also difficult to summarize simply. Aerospace is considered a crown jewel of Florida industry, local history, and overall social culture. This grass-roots identification has vital economic consequences and potential. Local laws favor business and are attentive

to aerospace. Space is a State priority, and policy makers send strong signals that it will not be allowed to erode.

Firm-level goals, however, may not be as aggressively innovative as they need to be. With an (understandable!) emphasis on cost, efficiency, standardization of operations, returns to invested capital, etc., local industry has the air of a "mature" industry, while ironically, opportunities for discontinuous innovation abound. This is a vulnerability. Sooner or later, the demand for space-based products and services will force discontinuous innovations in entire launch and launch vehicle architectures. The question being posed, again, is whether *Florida* firms will flourish relative to others in the industry, even others elsewhere in the nation.

Viewing this situation in evolutionary terms, it is likely that factor conditions alone can not sustain advantage in an industry like aerospace. In the first several decades of the space age, Florida and the nation made massive investments in local infrastructure, and to say that it also entered a stage of innovation would be an insulting understatement. The industry has advanced our civilization at a critical frontier. History can not be replicated elsewhere, at least not easily, quickly or at low cost. But theory might posit that some kinds of innovations and investments being made locally, at the time of writing, have a certain wealth-driven character. That is, much of the local space infrastructure is being "milked" for its economic potential, and stands at risk of technological and economic obsolescence. Much of the proposed re-investment has an air of modernization, not quantum improvement. NASA's privatization of Cape operations was wise in its intended context, but it is problematic that the proper free-market incentives exist for firms to establish entirely new launch paradigms. Again, it is very difficult for firms that have made huge, sunk costs in certain technologies, to throw it all out and start anew. Porter's advice for relentless improvement in all aspects of the diamond, *at a pace that exceeds advancements being made elsewhere*, is not entirely aligned with the reality of local conditions.

Does Florida possess comparative advantage in aerospace that could be exploited for firm-level competitive advantage? Yes, obviously. Is that advantage sustainable? Yes, in great part, but not all of it. Will Florida firms continue to enjoy sustainable competitive advantage? It is up to corporate, local, and national policy makers to determine.

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