Microeconomics of Competitiveness
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Automotive Cluster in Michigan (USA)

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1. Country Analysis: The United States

1.1. Analysis of Economic Performance

The United States is by far the largest economy in the world, with an annual gross domestic product of over $13 trillion in 2007.[1] Compared to other OECD countries and given its vast economy, the US has performed strongly, accounting for one-third of global growth from 1990 to 2005 (Council on Competitiveness, 2007). At a per capita income of over $45,000 in 2007 on a PPP basis, the US ranks only behind Luxemburg among OECD countries.[2] It registered a strong annual real GDP growth rate of 2.85% from 1998-2007, 1.25x the OECD average.[3]

A dynamic and flexible labor market has been instrumental to achieving the above impressive performance. With a workforce participation rate of 50.3% and unemployment rate hovering between 4% and 6% in the last decade, the country has been more adept at integrating immigrants, ethnic minorities and women than any other major economy in the world.[4] Somewhat defying the Philips curve, this low level of unemployment has been accompanied by a correspondingly low level of inflation of around 3% during much of this decade.[5]

Productivity has also been a major contributor to economic growth, increasing at a CAGR of 2.1% since the start of this decade compared to an OECD average of 1.6%.[6] In 2008, the US had one of the highest levels of GDP per hour worked ($54) in the world (See **Exhibit I**). This productivity boom began in the late 1990s, when American firms were better able to integrate information technology into their organizations than their European and Japanese counterparts.

The dynamism of the US economy is also manifest in its structural shift towards high-value goods and services. Over the last two decades, the economy has continuously shifted towards

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[1] GDP figure is in current dollars, International Monetary Fund (IMF) Web site, www.imf.org, accessed March 2009.
[2] IMF Web site, accessed March 2009.
[3] Ibid.
[4] Workforce participation rate (labor force % of total population) is an average from 2000-2005, Council on Competitiveness (2007) and Unemployment data from International Monetary Fund Web site, accessed Mar 2009.
[5] IMF Web site, accessed March 2009.
[6] The Conference Board Web site, www.conference-board.org, accessed March 2009.

services. Services now account for over three-quarters of GDP.[7] This evolution towards a knowledge-based economy has been fueled by America's high innovation capacity. It still has one of the highest levels of patents per capita in the world. In 2006, over 100,000 patents were registered to the US, by far the largest number for any country.[8] Worryingly though, that number has stagnated over the last five years. Other countries seem to be catching up; Taiwan now has almost the same patent intensity, and India and China are growing rapidly, albeit from a much lower base (See **Exhibit II**).

This worry about America's relative decline in innovation is further magnified when one analyzes whether Americans are equipped with the skills and knowledge to compete in this century. Deborah Wince-Smith, CEO of the Council on Competitiveness, asserts that it is "increasingly clear that most competition is being fought in the arena of ideas, learning and delivering new kinds of value to the marketplace" (COC, 2007:10). In this era of global competition from low-wage countries, it is imperative for the US to continuously upgrade its knowledge capabilities if the high wages to which Americans have grown accustomed to are to be sustained in the future. Yet, the trends are disturbing. America ranks 11th based on the percentage of young population with a college degree.[9] Further, in 2005, just 50% of high school graduates had the literacy skills needed to succeed in college (ACT, 2006). While the importance of science and technology has increased in the country's knowledge-based economy, Americans continue to perform poorly on basic math and science tests.[10] America's limited progress on education could significantly hinder its future competitiveness in the global marketplace.

Another issue confronting policymakers is the large current account deficit, which was 5.3% of GDP in 2007.[11] This deficit has grown from $522 billion in 2003 to $739 billion in 2007, on the back of fiscal and monetary easing following the dot-com bubble burst and the terrorist attacks of

[7] World Development Indicators (WDI) database, accessed March 2009.
[8] US Patent & Trademark Office (USPTO) Web site, www.uspto.gov, accessed March 2009.
[9] In 2005, 39% of 25-34 yr old population vs. Russia with 56% (#1), OECD (2007).

9/11.[12] These government actions resulted in higher consumption and consequently higher imports. Imports as a percentage of GDP grew from 14% in 2003 to 17% in 2007.[13] Additionally, the US is suffering in various export clusters, including automotive. In the decade preceding 2007, the country lost market share in 18 of its 20 largest export clusters (See **Exhibit III**).

This sustained deficit over the last two decades has been made possible by foreign financing of US consumption. As a result, gross external debt has ballooned from $6.4 trillion in 2003 to $13.4 trillion in 2007.[14] This has substantially widened the net international investment position, from 0% of GDP in 1985 to -18% in 2007.[15] Although US net income has broadly remained positive during the last two decades, it become negative (-$2.5 billion) for the first time in over 90 years in the second quarter of 2006 as interest rates went up (COC, 2007). These debt servicing costs will inevitably constrain America's ability to invest in innovation and education and hurt the county's competitiveness. While an argument can be made that the US current account deficit is sustainable as long as the country continues to maintain the confidence of foreign investors, it is equally plausible that this confidence may not last forever, making the US extremely vulnerable to a sudden drying up of foreign capital. The country is currently also witnessing "twin deficits", as the budget surplus of 2.4% of GDP at the start of this decade turned into a fiscal deficit of -1.2% of GDP in 2007.[16] Tax cuts as well as increased government spending have contributed to this growing deficit.

Another worry for policymakers has been the rising levels of income inequality indicating that gains from growth have not been shared equally. The Gini Index increased from 0.40 in 1980 to 0.47

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[10] In an international test (PISA) given to 15 year olds in 41 countries, Americans performed poorly, ranking 24th in mathematics and 17th in science, OECD (2007).
[11] WDI database, accessed March 2009.
[12] Ibid.
[13] Ibid.
[14] Gross external debt is the total amount of debt (government, corporations, or households) that is owed to foreign creditors, US Treasury International Capital System Web site, www.treas.gov, accessed March 2009.
[15] Bureau of Economic Analysis (BEA) Web site, www.bea.gov, accessed April 2009.
[16] Congressional Budget Office Web site, www.cbo.gov, accessed March 2009.

in 2006.[17] The top quintile of US households have increased their share of total income from 45% to 51%, while the bottom quintile have seen their share decrease from 4% to 3.4% during the same time period (1980-2006).[18] An analysis of absolute poverty does not illustrate an optimistic picture either. Although the poverty rate fell from 22% in 1960 to 13% in 2005, it has remained virtually the same since 2000.[19]

1.2. National Business Environment: US Diamond

The United States has decreased in competitiveness as evidenced by its fall from #2 in 2001 to #8 in 2008 in the latest rankings of the *Global Competitiveness Index* released by the Institute for Strategy & Competitiveness. This has been primarily driven by significant weakening of the macroeconomic environment, as discussed in the previous section, resulting in a drop from #7 in 2001 to #25 in 2008 in macroeconomic ranking. See **Exhibit IV** for the 2008 ranking of the US diamond against 134 countries.

1.2.1. Factor Conditions: #2 in 2001 to #3 in 2008

The US employs nearly one-third of the world's scientists and engineers, accounts for 40% of global R&D spending and publishes 30% of all scientific articles (COC, 2007). It is the largest investor in R&D by a wide margin but ranks 8th on R&D intensity.[20] The country is home to the largest number of researchers and 17 of the top 20 universities (SJTU, 2008). America also has the most sophisticated risk capital infrastructure and the largest VC industry in the world. The US has over 1,900 VC and private equity partnerships that manage over $800 billion in funds (NVCA, 2008).

That being said, the country is experiencing a negative "demographic dividend." The annual growth rate of the 55+ age group is projected to be 4%, compared to 0.3% for 25-54 year olds (COC, 2007). This is in sharp contrast to emerging economies like India and China, where the share of

[17] US Census Bureau Web site, www.census.gov, accessed March 2009.
[18] Ibid.
[19] Ibid.

young people in the labor force is forecasted to substantially increase. The anemic growth rate of the share of young people in the American labor force requires that they be more productive than their older peers to support the inevitably higher number of retirees. However, as discussed in Section 1.1, the US ranks poorly on international comparisons of basic math/science indicators and college graduation rates.

1.2.2. Demand Conditions: #11 in 2001 to #5 in 2008

With one of the highest income per capita levels (over $45,000) and home to the third largest population (over 300 million) in the world, the US is able to generate strong domestic demand (CIA World Factbook, 2008). Indeed, the American consumer has been one of the primary contributors to global economic growth in the last decade (Alfaro and DiTella, 2009). Further, with 16 of the 25 most innovative companies being American firms, it seems reasonable to postulate that the US consumer is fairly sophisticated (Business Week, 2008).

However, increasing healthcare, energy and debt service costs mean that Americans have less disposable income than before (COC, 2007). Further, rising energy prices, energy security concerns and climate change issues has led to a "greening" of demand among some consumers, which in turn could create attractive market opportunities for firms to create more energy-efficient products.

1.2.3. Related & Supporting Industries: #2 in 2001 to #1 in 2008

The US has an advanced cluster ecosystem with well-developed regional clusters in all the major industries in which it competes. These clusters provide a strong breadth and depth of supporting suppliers that are very beneficial to entrepreneurs and firms in commercializing ideas.

1.2.4. Context for Firm Strategy & Rivalry: #4 in 2001 to #3 in 2008

Compared to other innovation driven economies, America has the largest percentage of its adult population (over 10% in 2008) engaged in some form of entrepreneurial activity (Global

[20] Average R&D Spending (% of GDP) in 2003-2006, National Science Foundation Web site, www.nsf.gov, accessed March 2009.

Entrepreneurship Monitor, 2009).[21] One of the contributing factors is a regulatory structure that enables firms to start up and become productive while also allowing inefficient firms to close down. In the *2009 Doing Business* report published by the World Bank, America ranks 3rd in "Ease of New Business," 6th in "Starting a New Business," and 15th in "Closing a Business" out of 181 countries. Perhaps more important though is the cultural attitude embedded within US society that encourages risk-taking and does not stigmatize failure.

Conglomerates do not dominate in America; in fact small and medium firms (those with less than 500 employees) drove employment growth in the last decade. From 1989 to 2002, SMEs created more new net jobs than large firms in every year except 1991.[22] However, SMEs are increasingly being burdened with ballooning healthcare costs[23], which may jeopardize their standing as engines of US growth.

With over 30 million jobs being churned every year, the US is the most flexible labor market in the world (COC, 2007). This high level of churn helps the economy be more dynamic as workers shift relatively quickly from less productive to more productive clusters. This traditional nimbleness is currently under pressure with the potential passage of The Employee Free Choice Act. This act is pending legislation in Congress and if passed would make it easier for employees to form and join unions. Further, the collapse in the housing markets has also increased rigidity in the labor market, making it difficult for workers with mortgages to sell their homes.

[21] Adult population defined as between ages of 18-64, Global Entrepreneurship Monitor (2009).
[22] Small Business Administration Web site, www.sba.gov, accessed May 2009.
[23] As the healthcare system in US is employer based, it imposes an especially heavy cost on American firms. Healthcare consumes nearly 16% of US GDP as compared to 8%-10% in most other industrialized companies. Auto Trade Policy Council Web site, www.autotradecouncil.org, accessed March 2009.

1.3. Implications of Current Economic Crisis on US Competitiveness

1.3.1. Worsening Macroeconomic Situation[24]

The macroeconomic outlook for the next few years is not pretty. Real GDP growth is forecasted to decrease by 3.2% this year, and it is expected to be another five years until GDP growth numbers reach pre-crisis levels. The current fiscal stimulus and bailout package will cause the budget deficit to balloon to -13.1% of GDP this year from -3.2% in 2008. While the deficit may decrease in the next few years, it is still forecasted to be -7.3% in 2013. Public debt will also substantially increase over the next few years and is estimated to reach $12.5 trillion in 2013 (82% of GDP) up from $5 trillion in 2007 (37% of GDP). This negative outlook on multiple indicators has the potential to hurt US competitiveness going forward.

1.3.2. Protectionism

Dismal macroeconomic data may increase protectionist sentiment. There are already worrying signs of increased restrictions on trade and capital flow. The US currently ranks 20th in openness to capital flows, 39th in high tariff rates and 43rd in lack of foreign ownership (Global Competitiveness Report, 2008). The controversy around the "Buy American" provision in the stimulus package, which mandated that all manufactured goods purchased with stimulus money be made in the US, further highlights the anti-globalization mood pervading Congress. While the clause was thankfully diluted, there are still lingering concerns of future protectionism. For instance, the House has already passed a bill requiring the use of domestic iron and steel, which will have adverse effects on the automotive cluster as discussed in Section 3 of this paper (Lynch, 2009).

1.3.3. Immigration

The current crisis may also hurt labor mobility with the nationalistic desire to stem the flow of immigrants due to the populist perception that their arrival results in job losses and lower wages for Americans. On the contrary, America's willingness to welcome foreigners has been and will be

crucial to its economic success. Foreign students accounted for 60% of the growth in the number of PhDs in science and engineering in the 1990s (Freeman, 2005). Per capita, immigrants have also started more firms than native US citizens. Approximately 350 out of 100,000 immigrants establish a business per month compared to 280 out of 100,000 natives (Kauffman Foundation, 2006). Some of America's most celebrated firms – Google, Yahoo!, Sun Microsystems – were created by immigrants. Far from reducing growth, immigrants have actually played a major role in US economic success over the last two decades. It is imperative that the US continues to maintain open and free borders.

1.3.4. Innovation

The government's role in funding basic research and being a lead customer should not be underestimated. Disruptive technologies like the Internet, Doppler radar and laser were built using federal money. Unfortunately, federal funding for R&D decreased from $117 billion in 2007 to $113 billion in 2008, with the 2008 figure being 7.3% lower in real terms than the 2005 amount.[25] As federal funds have decreased, America has suffered from a "brain drain," with an increasing number of scientists moving to countries like Japan, China, and India that are becoming more supportive of research. For instance, since 2003, about 60,000 high skilled Indians have returned home (Bora and Bowers, 2009). This brain drain will hurt the country's traditional strengths of entrepreneurship and innovation. In 2007, Bill Gates, at a congressional hearing, urged the government to increase funding in basic research, declaring that "the challenges confronting America's competitiveness and technological leadership are among the greatest we have faced in our lifetime" (Bora and Bowers, 2009). With the economic crisis and ballooning budget deficit, there is a significant possibility that federal research funding will continue to decrease.

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[24] All estimates taken from Economist Intelligence Unit, www.eiu.com, accessed May 2009.
[25] National Science Foundation Web site, accessed May 2009.

2. State Analysis: Michigan

2.1. History

With a population of nearly 10 million[26] and a gross state product of 382 billion USD,[27] Michigan is the 8th and 12th largest state in the United States by population and GSP respectively. French settlers were the first Europeans to occupy the territory in the early 17th century, but the British ended the French rule in 1760 and Michigan became the 26th state to join the union in 1837 (Rosentreter et al, 2001). The fur trade was the dominant economic activity until copper and iron ore mining started in the mid 19th century. Michigan's logging industry was also very strong during that period, and the state's sawmills produced 25 percent of the nation's lumber in the 1880s (Rosentreter et al, 2001).

The construction of the Erie Canal in 1825, which linked the Hudson River with Lake Erie, led to a significant influx of migrants and facilitated the transport of goods. These factors contributed to the growth of Michigan's manufacturing sector, and the state became the world's leading producer of iron stoves and the national leader in manufacturing railroad cars (Rosentreter et al, 2001). In 1908, Ford produced the first Model T, which marked the beginning of the era of Michigan's leadership in the automotive sector.

2.2. Analysis of Economic Performance

The growth of the manufacturing sector led to a long period of prosperity for Michigan, as the growth of the US economy in the 20th century created strong demand for industrial products. Manufacturing is still the dominant economic activity in Michigan, accounting for 21% and 17% of the state's GSP and employment in 2006 respectively. [28] Automotive accounts for a significant share of manufacturing activity, representing 10% of Michigan's GSP and 6% of employment in 2006,

[26] State of Michigan Web site, www.michigan.gov, accessed March 2009.
[27] BEA Web site, accessed March 2009. GSP figures in constant 2000 dollars.

which does not account for related industries such as transportation and logistics, finance and insurance, chemical, plastic, or metal manufacturing.[29] Michigan leads the US in automobile manufacturing and is the home to the Big Three automakers, General Motors, Chrysler and Ford. Automotive is the dominant cluster in Michigan, evidenced by the cluster in 2007 representing 18% of total employment in the state's traded clusters, and related industries such as metal fabrication, plastics and chemicals accounting for another 34% of traded cluster employment.[30]

Although the growth of the manufacturing sector enabled Michigan to enjoy a long period of prosperity during most of the 20th century, the state has experienced substantial economic challenges over the last decade. At 0.01%, Michigan has had the lowest annual real GSP per capita growth rate in the nation from 1998 to 2007.[31] The state has the lowest employment growth rate (-0.32% from 1998 to 2006), and its GSP per capita has fallen substantially below the national average ($32,846 in Michigan vs. $38,020 in US in 2007).[32] The unemployment rate in Michigan was 8.4% at the end of 2008 vs. 5.8% for the US.[33] The economic stagnation is primarily driven by the fact that the economy is heavily reliant on the automotive cluster, which has been going through a difficult period, as discussed in Section 3.5. The Michigan automotive cluster accounts for 17.6% of national cluster employment, but has lost 4.1% share to other states from 1998 to 2006 (See **Exhibit V**).

2.3. State Business Environment: Michigan Diamond

As exemplified by the rise and decline of the automotive cluster (as discussed in Section 3), Michigan benefits from several attributes that have enabled the state to become a leading manufacturing center, but the state currently faces several challenges to its competitiveness.

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[28] GSP from BEA site while employment data from Bureau of Labor Statistics Web site, www.bls.gov, accessed March 2009.
[29] Ibid.
[30] Bureau of Labor Statistics (BLS) Web site, accessed March 2009.
[31] Institute for Strategy and Competitiveness (ISC) Web site, www.isc.hbs.edu, accessed March 2009.
[32] BEA Web site, accessed March 2009. GDP figures in constant 2000 dollars.
[33] BLS Web site, accessed May 2009.

2.3.1. Factor Conditions

Located near the Great Lakes, Michigan benefits from strong transportation routes. Its proximity to Canada has made Michigan that country's largest US state trading partner.[34] In addition to having access to shipping, Michigan has 17 commercial airports and 10 cargo airports.[35] However, Michigan's infrastructure suffers from underinvestment. In fact, Michigan is ranked the 8th and 4th worst state in urban and rural area infrastructure respectively, and poor road conditions and traffic delays cost Michigan drivers over $7 billion annually.[36]

Michigan has 131 higher education institutions with over 287,000 students,[37] which partly explains why Michigan is ranked as one of the most innovative states in the US, with the 10th highest patent intensity (9.71 patents per 10,000 employees in 2006).[38] Despite such a strong university system, in 2000 only 21.8% of the 25+ population had a college degree compared to a nationwide percentage of 24.4%.[39] Further, 31.3% of the 25+ population had a high school degree as their highest educational level, compared to 28.6% across the country.[40] It seems that the prevalence of low skilled jobs with relatively good wages, through strong union presence in the state, has created a disincentive to pursuing higher education.

2.3.2. Demand Conditions

With a GSP of $382 billion, Michigan has the 12th largest GSP in the United States[41]. Unfortunately, the state is currently experiencing flat GSP growth and the average wage in Michigan is $39,666, which is 0.75% below the national average.[42] The low average wage combined with the

[34] Census Bureau Web site, Foreign Trade Statistics, www.census.gov/foreign-trade/statistics, accessed March 2009.
[35] Michigan Department of Transportation, Aeronautics Web site, www.michigan.gov/aero/, accessed March 2009.
[36] Drive Michigan Web site, www.drivemi.org, accessed March 2009.
[37] US Census Bureau Web site, accessed March 2009.
[38] ISC Web site, accessed March 2009.
[39] US Census Bureau Web site, accessed March 2009.
[40] Ibid.
[41] BEA Web site, www.bea.gov, accessed March 2009.
[42] ISC Web site, accessed March 2009.

high unemployment rate (8.4% in 2008)[43], and lowest average wage growth rate in the nation (2.4% during 1998-2006)[44] creates a bleak outlook for demand growth in Michigan.

2.3.3. Related & Supporting Industries

As mentioned earlier, the Michigan economy is heavily reliant on manufacturing, especially the automotive cluster. The state benefits from a complex web of industries that support the automotive sector, which include metal fabrication, plastics, and finance and insurance industries. However, Michigan lacks strong supporting industries in sectors that are not related to automotive or manufacturing. The state government is taking steps to develop other clusters, such as alternative energy and life sciences, to reduce Michigan's heavy dependence on automotive.

2.3.4. Context for Firm Strategy & Rivalry

Michigan was ranked the 2nd most business friendly state in the nation by *Site Selection* magazine and is home to 33 Fortune 1000 companies. The Michigan government has undertaken several policies focused on diversifying the economy and reduced taxes in 1990s to bring the state in line with the US average. Although Michigan ranks high in terms of innovation, the majority of patents are held by large automotive companies, further highlighting the lack of industry diversification.[45] Entrepreneurial activity is very limited. The state ranks 44th (out of 51) in the growth of new ventures in traded industries, 1.03% vs. 2.10% for the US during 1998-2006.[46] Also, well-educated people who would be suited for knowledge-based industries are leaving the state. The state suffered an outward migration of 239,000 from 2000 to 2006.[47]

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[43] BLS Web site, accessed March 2009.
[44] ISC Web site, accessed April 2009.
[45] The seven companies that registered highest cumulative number of patents in the state during 2001-2006 were automotive firms. USPTO Web site, accessed March 2009.
[46] ISC Web site, accessed April 2009.
[47] US Census Bureau Web site, accessed March 2009.

3. Cluster Analysis: Automotive

3.1. Automotive Cluster Map

Although the automotive cluster is currently going through a turbulent phase, the cluster is very well developed, consisting of leading upstream and downstream businesses, as well as strong associations, governmental, and educational institutions. See **Exhibit VII** for a detailed cluster map. Over 50% of North American auto companies are based in Michigan, and 46 of the top 50 global auto suppliers have operations in the state.[48] The US also has the most advanced secondary car market, which is supplemented by well-developed auto financing, insurance and aftermarket services. In addition, Michigan has 250 automobile technical centers, and 58 colleges and universities that are focused on engineering and automotive.[49] Finally, US government policy has been very friendly to auto companies. For instance, the country has one of the lowest gas prices in the OECD.[50]

3.2. Birth of the Cluster [51]

At the beginning of the 20th century in Michigan, all four parts of the diamond created an ecosystem that was conducive to automotive entrepreneurship and attracted the likes of Henry Ford, Billy Durant, and Ransom Olds.

3.2.1. Factor Conditions

Michigan provided proximity to needed raw materials. In the 1890s, the state was the leading producer of wood and copper. Iron ore was also easily available through three sites in the upper peninsulas and the Mesabi range in Minnesota. The Great Lakes location offered access to major markets such as the fast growing cities of New York and Chicago. The strong railroad network also connected Michigan to the South and West. Michigan also had an abundance of non-unionized, highly skilled workers. The strong presence of cast iron stoves, carriage and wagon industries meant

[48] Michigan Economic Development Corporation Web site, www.MichiganAdvantage.org, accessed March 2009.
[49] Ibid.
[50] WDI Web site, accessed March 2009.

the existence of workers who were accustomed to working with metals. Finally, with the accumulation of wealth through copper, mining and timer industries, "venture capital" was easily available to fund automotive investments.

3.2.2. Related & Supporting Industries

At the beginning of the 20th century, internal combustion (gasoline) was vying with steamer and electric as the engine of choice for automobiles. Compared to the gasoline automobile, the electric car was much more expensive to manufacture and operate. While the steamer used an equal amount of petroleum fuel (as the gasoline car), it also consumed water. Further, its technology had peaked compared to the significant technological advances that gasoline was undergoing. As gasoline became the dominant engine choice, the center of automobile manufacturing shifted from New England to Michigan. Michigan already had a strong presence in manufacturing of stationary gasoline engines that were widely adopted on mid-western farms due to the region's poor roads, which made electric cars inoperable, and the availability of gasoline as fuel in rural areas. Home to excellent hardwood forests, Michigan was also the center for carriage and wagon manufacturing and trade. Thus, the state offered automobile manufacturers access to suppliers of gasoline engines, bodies, and wheels.

3.2.3. Context for Firm Strategy & Rivalry

Competition was fierce in the early days of the automotive cluster. Weak players were ruthlessly weeded out. 485 firms entered the market between 1900 and 1908 and only 285 remained in 1910 (Flink, 1975). Michigan politics was also dominated by the Republican Party that was very pro-business and created a stable economic and banking climate. Unlike Europe during this time, there were no national subsidies for this cluster as the War Department showed limited interest. This lack of subsidization to manufacture heavy cars and trucks for military purposes proved to be

[51] Information in this section was collected, unless noted otherwise, from expert interviews.

beneficial as it enabled American manufacturers to focus on light cars for consumer purposes (Flink, 1988).

3.2.4. Demand Conditions

The arrival of the automobile was celebrated with significant enthusiasm by Americans. By 1907, it was viewed as a necessity (Flink, 1988). With approximately 458,500 motor vehicles registered in 1910, the sector had leapt to 21st in value of product among national industries (Flink, 1988). In no other country was the pace of implementation this quick.

3.3. Evolution of the Cluster

There were many reasons that contributed to the meteoric rise and dominance of the automotive cluster in Michigan. First, the demand conditions in the US were particularly robust. US government policy enabled the demand for automobiles through the National Highway Acts of 1956 and 1958, which provided the funds for significant construction of and improvements to the national interstate highway system. The US built over 2.6 million miles of paved roads, supporting the world's largest market for automobiles.[52] Consequently, the suburbanization of America created a consumer who became completely dependent on the automobile for transportation. Also, the idea of freedom of mobility became engrained in the American psyche and none of the competing alternatives, like railroads or steam ships that relied on set timetables, could compare with the individuality of the automobile. The automobile in the US gained iconic status and new models were eagerly anticipated by the consumer. The US market grew to over 111 million registered vehicles in 1970.[53]

The Big Three automotive manufacturers that were based in Michigan enjoyed access to this enormous market with very little competition until the 1970s. The decades following World War II saw huge increases in the size and sophistication of demand, with no credible threats from foreign automakers, as Europe and Asia were still recovering from the devastation of the war. However, the

[52] US Department of Transportation, Federal Highway Administration Web site, www.fhwa.dot.gov, accessed April 2009.

oil embargo in 1974 and the oil shock in 1979 significantly changed the US consumers' preferences as the gas guzzling iconic American cars no longer met their needs (Flink, 1988). Additionally, newly enacted fuel efficiency standards in 1975 meant that many of the Big Three's cars no longer complied with government regulations (Hillstrom and Hillstrom, 2005).

3.4. Transplant Manufacturers

As the Big Three struggled to build cars to meet new consumer demands and government regulations, Asian manufacturers began to export compact, fuel-efficient models. The financial difficulties from loss of sales to imports were complicated by the creation of domestic plants by foreign manufacturers (transplants). This change in the nature of competition disproved the Big Three's assertion that their financial woes and lack of competitiveness with imports were solely due to high domestic labor costs as the transplants were able to successfully compete using US labor.

As consumer preferences evolved and Americans began purchasing foreign cars, the gap in quality between the Big Three and their foreign competitors became clear. The American auto manufacturers had competed on styling and cost reductions rather than quality, safety and reliability. Forced to compete with foreign imports and transplants, the US automakers had to restructure and overcome the technological stagnation that had typified the 1970s (Flink, 1988). By restructuring manufacturing processes, the cluster in Michigan rebounded until the stock market crash of 1987, after which the ensuing recession further depressed sales. While the Big Three made improvements to quality from the infamous debacles of the Ford Pinto and the Chevy Corvair in the 1960s and 1970s respectively, they continued to lag the transplants. The transplants overtook the Big Three in Consumer Report's quality ratings in 1972 and remained ahead for decades.[54] The Big Three mitigated overall market share losses in the 1990s by creating a new market segment for sport utility vehicles and light trucks. However, despite improving their financial performance, the Big Three

[53] Ibid.

began to use financing incentives as the basis for competition in contrast to the transplants that focused on product differentiation and meeting customer needs (Hillstorm and Hillstrom, 2005). Only recently has the quality gap started to close. 20%+ decreases in the problems per vehicle between 2001 and 2005 have brought the Big Three almost in line with industry averages.[55] Unfortunately, despite these recent gains, the cluster in Michigan still suffers from a perceived quality gap. See **Exhibit IX** for a breakdown of US market share from the 1970s.

3.5. Strategic Issues

The Michigan cluster is increasingly under threat from a new cluster in the South dominated by Asian transplants. From 1998-2006, the only positive job creation in the automotive sector was in the Southern cluster (~35,000 jobs).[56] This is in stark contrast to Michigan where close to 105,000 jobs were lost during that same time period.[57] Factor conditions have influenced this choice of geography, including access to non-unionized labor, lack of legacy pension and healthcare costs, and the lower costs of establishing a plant. The investment attraction efforts by state governments in the South have also been focused on improving infrastructure and employee training. Unfortunately, Northern state governments have focused predominantly on tax incentives at the expense of upgrading the competitiveness of their region and cluster (Hill and Brahmst, 2003).

Higher labor and healthcare costs put the Big Three at a significant disadvantage versus their Asian peers, with a cost disadvantage of $1,500 per car (Oliver Wyman, 2008). In 2005 the Big Three spent $12 billion on healthcare as compared to $1.6 billion by the Asian Three.[58] The Big Three also suffer from larger pension obligations. In 2005, the Big Three spent $11 billion on 739,000 pension

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[54] Consumer Reports Web site, www.consumerreports.org, accessed April 2009.
[55] JD Power and Associates Web site, www.jdpower.com, accessed April 2009.
[56] ISC Web site, accessed April 2009.
[57] South Cluster includes Alabama, South Carolina, Kentucky and Tennessee, ISC Web site, accessed April 2009.
[58] Asian Three includes Toyota, Honda and Nissan, Auto Trade Policy Council Web site, www.autotradecouncil.org, accessed March 2009.

beneficiaries whereas their Asian counterparts spent $23 million on 1,200 recipients.[59] The Big Three's extended dominance of the US market allowed the United Auto Workers (UAW) union to sign labor contracts that captured more rents in the form of higher wages and health benefits than those provided by the transplants. This cost disadvantage combined with an inability to increase willingness to pay due to inferior product design has led to significant profitability challenges for the Michigan cluster.

This quality gap is further reinforced by comparisons of innovation between the Big Three and their Asian competitors. While the Big Three registered more patents than their Asian peers in the 1970s, in every subsequent decade that trend has been reversed, with the Asian Five generating a cumulative of 26,709 patents from 1980 to 2006, compared to 21,524 for the Big Three.[60] From 2001-2006, the Asian Three have increased R&D at a CAGR of 8.9% compared to an anemic 0.9% for the Big Three, so much so that in 2006, Toyota overtook Ford as the world's largest commercial R&D spender (IEEE Spectrum, 2007). The consumer focus of the Asian transplants has also produced greater successful commercialization of R&D. The focus on cost reduction at the expense of quality engineering and product design has created a legacy that haunts the Michigan cluster even today.

The US automotive manufacturers have also become increasingly uncompetitive in the global marketplace. American market share in world exports has fallen from 11.7% in 1997 to 8.5% in 2007.[61] Declining US competitiveness in the world market is particularly concerning given the expectation of flat demand in the US, the market in which they remain most competitive, and significant growth in the Chinese and Indian markets. Chinese demand is forecasted to increase from 10% of the global market in 2006 to 17% in 2013, with the country most likely surpassing America as the world's largest vehicle market at some point between 2014 and 2018 (Levy, 2008). **Exhibit**

[59] Ibid.
[60] Asian Five includes Asian Three, Hyundai and Mazda, USPTO Web site, accessed March 2009.

VIII further illustrates the precarious position of the US in global markets. Germany and Japan are much larger exporters, while competing clusters in Canada and France are almost as big and shrinking more slowly. Korea's growing cluster poses a significant threat with a 4% share in 2005 and a relatively strong growth in market share of 1.6% from 1997-2005.[62] The globalization of demand and increasing importance of export markets does not bode well for the Michigan cluster.

3.6. Automotive Cluster Diamond

The Michigan automotive cluster diamond is incredibly well developed and all aspects of the diamond maintain significant strengths. However, weaknesses in the diamond in conjunction with changing market conditions have resulted in the cluster experiencing a serious crisis. See **Exhibit X** for an analysis of the automotive cluster diamond.

3.6.1. Factor Conditions

The Michigan cluster maintains the 4th largest hi-tech workforce in the United States supported by the presence of 250 technical training centers and the University of Michigan, an elite engineering institution.[63]

High labor costs plague the competitiveness of the cluster in part due to the strength of UAW. For example, average wages for Big Three workers in 2007 were $75 per hour versus $47 for Toyota (Oliver Wyman, 2008). As previously mentioned, the legacy healthcare and pension costs of the Big Three put the cluster at a substantial disadvantage to other auto clusters in the South and in other countries.

Steel is a key input to car manufacturing. The significant protection of the steel industry has increased costs for US automotive suppliers and manufacturers. Protection in the steel industry also

[61] ISC Web site, accessed April 2009.
[62] Ibid.
[63] Michigan Economic Development Corporation Web site, accessed March 2009.

hampers R&D, and lack of access to new metals technologies reduces innovation by the cluster in Michigan. These protectionist policies have hurt the international competitiveness of both industries.

3.6.2. Demand Conditions

The cluster benefits from America being the largest automotive market in the world comprising 20% of global demand (Levy, 2008). The country has the largest demand density in the world at 800 cars per 1,000 people (Levy, 2008). However, US demand is expected to be flat, growing at only 0.4% through 2011.[64] Furthermore, the "greening" of transportation and the move to more energy efficient transportation will shift demands toward more fuel-efficient, hybrid cars where Michigan has not traditionally been competitive.

3.6.3. Related & Supporting Industries

Numerous industries have sprouted in Michigan accompanying the rise of the automotive cluster. First, 50% of North American automotive companies are based in Michigan, including 46 out of the top 50 global auto suppliers.[65] However, the lack of independence among these suppliers reduces the cluster's competitiveness. For example, GM's backstop of Delphi and Ford's support of Visteon has allowed these suppliers to continue to operate inefficiently despite reorganization.

Leading global plastics and chemical companies such as Dow Chemical and DuPont have either headquarters or major operations in Michigan, which support the operations and R&D of the automotive cluster. The Ontario automotive cluster also represents a supporting cluster given its proximity to Michigan and the commercial exchange between the two regions. Furthermore, a meaningful business services cluster, including specialized automotive consulting services, has sprouted around the automotive cluster (Oliver Wyman, 2008). While many of the supporting industries include world class firms, some of them are facing fierce global competition that is eroding

[64] CSM Worldwide Web site, www.csmauto.com, accessed March 2009.
[65] Michigan Economic Development Corporation Web site, accessed March 2009.

their competitive position. For example, the leading tire industry in neighboring Ohio is slowly losing market share to international players (Levy, 2008).

3.6.4. Context for Firm Strategy & Rivalry

The national automotive market is extremely competitive. As discussed earlier, unfortunately the Michigan cluster has largely responded to competition not with greater innovation in product quality but rather with auto financing incentives.

Given that the automotive sector represents 4% of GDP[66] and generates meaningful employment for the country, the US government has often intervened in the sector during times of crisis, as in the recent government loans. Similarly, in 1979, on the verge of bankruptcy, Chrysler petitioned the U.S government and received a $1.5 billion bailout loan (Time Magazine, 1979). The political implications of failure of such a large employer and iconic industry have prevented the government from allowing any of the Big Three to fail.

3.6.5. Institutions for Collaboration

Not to be overlooked are the Institutions for Collaboration supporting the cluster, including the University Research Corridor, Center for Automotive Research, Alliance of Automobile Manufacturers, and the Engine Manufacturers Association. These IFCs assist the cluster in a variety of ways, including sharing best manufacturing practices, lobbying the government, and developing joint R&D platforms. Their coordination will be critical as the cluster focuses on improving its innovative capacity and competitive position.

3.7. Recent Events in the Michigan Cluster[67]

The current economic crisis has accelerated the downward spiral of the Michigan cluster. The tightening of the credit markets limited access to auto financing, thereby eroding the basis of the Big

[66] BEA Web site, accessed May 2009.
[67] Timeline and quantitative information in this section is taken from the section on the automotive crisis at the Financial Times Web site, www.ft.com/indepth/detroit, accessed May 2009.

Three's competitiveness. The dire financial situation at the Big Three led them to request government funding in November 2008. The chief executives of these firms argued at congressional hearings in Washington DC that the usual route of bankruptcy filing for distressed companies was not feasible for them as doing so would lead to depressed demand for their cars and subsequently put millions of livelihoods tied to the automotive sector at risk. President Bush gave GM and Chrysler emergency loans worth $17 billion in December 2008, while Ford decided to restructure without government assistance. Requests for additional financial assistance were denied by the government on March 30, 2009, and GM and Chrysler were forced to either present a viable restructuring plan within 60 and 30 days respectively or file for bankruptcy. Chrysler declared bankruptcy on May 1, 2009, after failing to reach a restructuring agreement with its creditors. The company has already managed to negotiate wage reductions and other concessions with both American and Canadian auto workers and has signed an agreement to enter into a partnership with Italian automaker Fiat. Under the agreement, Fiat will provide technology and in return will largely have control of Chrysler's operations. Fiat will have a 20% stake in Chrysler, with incentives to increase its share of the company to 35%, the US government will have an 8% stake and the UAW will have a 55% stake through a healthcare trust. The takeover of Chrysler is part of Fiat's plan to create a pan-European car group that would combine Fiat's auto business, GM Europe, and Chrysler. The plan is not finalized, but the restructuring of Chrysler is likely to serve as a blueprint for the reorganization of GM and Ford.

If executed, the restructuring would enable the companies to reduce capacity, negotiate more favorable labor agreements, and shed some legacy liabilities. This would help address the cost disadvantage the companies are facing, but it unclear whether these actions will address the need for R&D, better products, and higher quality. In addition, the restructuring as planned may be more of a short-term solution than a long-term one, since the UAW would retain a 55% stake in Chrysler. Although the UAW would only get one board seat and may have to sell their shares to fund healthcare liabilities, the labor unions may have meaningful influence on the company.

4. Recommendations

4.1. National Recommendations

First, the United States must re-focus on its traditional strengths of innovation, entrepreneurship, and free competition. As mentioned in Section 1, the country is beginning to lag in many competitiveness indicators related to education, trade reform and capital mobility. Protectionist and anti-bankruptcy sentiments seem to be rising. With the recent automotive and financial bailouts, the country appears to be gravitating away from free competition principles. Key constituencies to play a central role include the White House, Congress and other governmental agencies such as the Department of Education and the Department of Commerce.

Second, the US must seek to decouple healthcare benefits from employment. As mentioned in Section 1, the current employer-based healthcare system imposes a large burden on both small and large firms. Currently, the healthcare liabilities put many US clusters at a significant competitive disadvantage compared to firms in countries where universal healthcare is already provided. With the globalization of demand and thus increasing importance of exports, Congress must take the lead on enacting healthcare reforms that will improve the global competitiveness of US auto manufacturers and all businesses competing internationally.

Third, the country must develop a holistic and coordinated national automotive policy. Currently, various government departments work in silos and mandate inconsistent policies. For instance, the CAFE regulation mandates a mileage per gallon (mpg) standard of 35 miles by 2020, but another national regulation requires a safety rollover roof, which makes a car much heavier and in turn reduces mpg.[68] This inconsistency is exacerbated by disparate state policies. California (and other states following California's lead) have legislated a stricter regulation of 42 mpg by 2020.[69] The

[68] Expert interview with John McElroy, March 30, 2009.
[69] Ibid.

White House needs to spearhead the creation of a regulatory body that works with national government agencies and state governments to formulate unified and consistent automotive policies.

Fourth, the current housing crisis is reducing labor mobility. Because home values have fallen so substantially, many people can not afford to sell their homes. Creating federal programs to purchase homes or reduce mortgages may assist in moving labor to areas with job availabilities.

4.2. State Recommendations

First, Michigan should position itself as a center for alternative energy. As mentioned in Section 2, the state is heavily dependent on the automotive cluster, which need not necessarily be negative. The state can capitalize on its traditional strengths in automotive by encouraging the development of related clusters such as alternative energy. State legislation could provide research funding for alternative fuels, wind and solar energy, lithium batteries, and hybrid vehicles. The state could also provide incubator resources and VC funding to alternative energy startups.

Second, Michigan should seek to dismantle incentives to not attend college. As mentioned in Section 2, the prevalence of low-skilled jobs with relatively good pay in manufacturing has traditionally been a disincentive to pursuing higher education. Through part-time worker training programs and non-profits, which bridge the gap between academia and the private sector, the state government can play an important role in educating its young population.

Third, informed elected representatives from Michigan and IFCs should educate policy makers on the competitiveness implications of The Employee Free Choice Act. As mentioned in Section 1, this act will enable workers to more easily unionize, making the labor market more rigid and potentially making the automotive cluster and other manufacturing clusters in Michigan even more uncompetitive.

4.3. Cluster Recommendations

First, the automotive cluster should seek to upgrade itself as the North American and global center for R&D. The cluster has the potential to leverage its world-class R&D and engineering ecosystem to attract knowledge intensive jobs from other companies in the global automotive cluster. There already exists precedent for such dynamics. For example in 2008, Toyota opened a $187 million R&D facility in the state, employing 400 people.[70] This was the second such site for the company; the first one was opened in 1997 and employs 700 people.[71] Both centers are engaged in advanced technical research, engineering design and prototype building. Shigeki Terashi, President of Toyota's Technical Center, states that the company "recognizes Southeast Michigan as its center for automotive R&D in North America."[72] IFCs can play a leading role in promoting the cluster as a hub for cutting edge R&D.

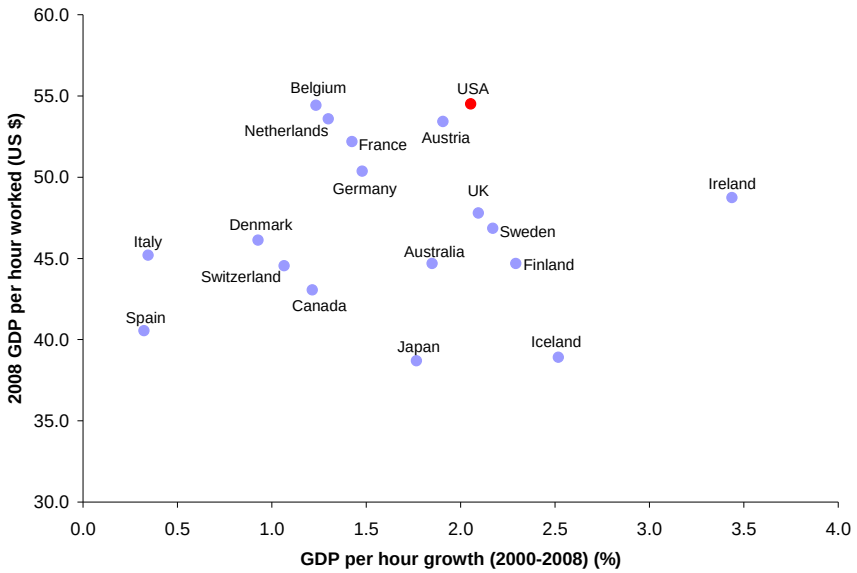
Second, in seeking to improve competitiveness, the Big Three could focus on manufacturing models which require advanced engineering and superior craftsmanship. Such high labor input models would lead to increased margins and support higher wages for the skilled workers in Michigan.

Third, in the event the cluster is unable to resolve its structural labor issues with the UAW, the CEOs of automotive companies, with the support of the national government, should consider allowing low-end mass manufacturing to leave Michigan to more competitive locations in the South and overseas.

[70] Toyota Web site, Press Releases Section, www.toyota.com, accessed March 2009.
[71] Ibid.
[72] Ibid.

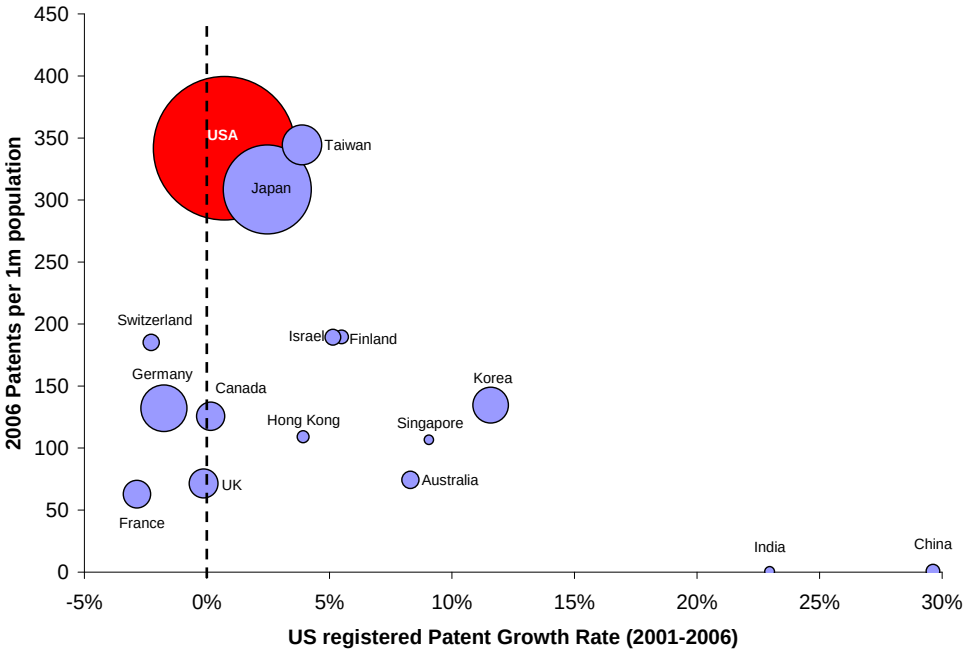
Exhibits

Exhibit I: Productivity, US vs. OECD Countries, 2000-2008



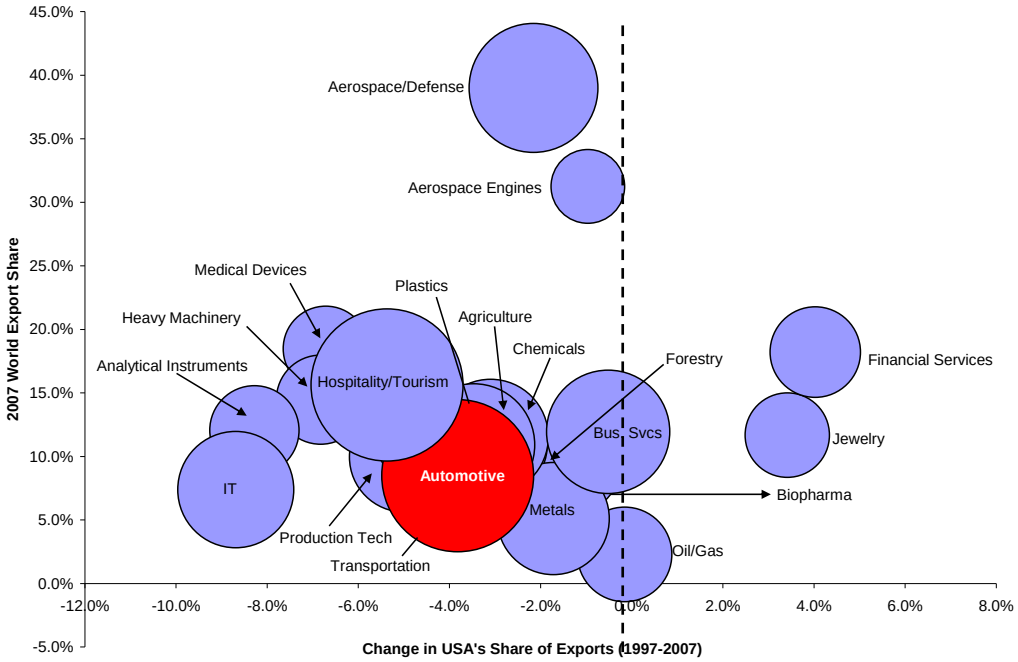
Source: The Conference Board Web site, www.conference-board.org, accessed March 2009.

Exhibit II: Patent Intensity and Growth, US vs. Other Countries, 2000-2006



Source: US Patent and Trademark Office, "Patent Counts by Country/State and Year", March 2008.

Exhibit III: Export Competitiveness, US Top 20 Clusters, 2007



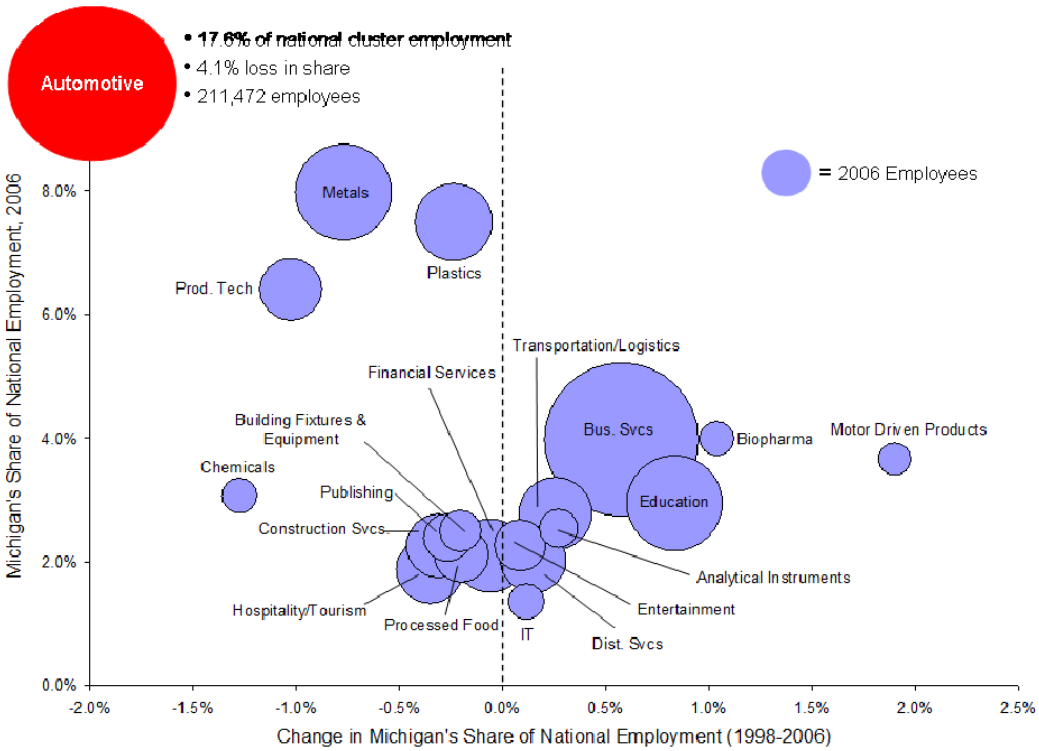
Source: Institute for Strategy and Competitiveness Web site, www.isc.hbs.edu, accessed March 2009.

Exhibit IV: US National Diamond

	Strengths (Rank/134)	Weaknesses (Rank/134)
Factor Conditions	• Venture capital availability (1) • Quality of scientific research (1) • Quality of management education (1) • Financial market depth (2)	• Burden of government regulation (53) • Mobile phone penetration (57) • Quality of basic math and science education (58) • Soundness of banks (61)
Demand Conditions	• Buyer sophistication (4) • Government purchase of advanced tech products (4) • Laws relating to ICT (7)	• Stringency of environmental regulations (17) • Government success in ICT promotion (28)
Context for Firm Strategy & Rivalry	• Lack of conglomerate dominance (1) • Employment flexibility (1) • Intensity of local competition (1) • Strength of auditing standards (1) • Board efficacy (4)	• Openness in capital flows (20) • High tariff rates (39) • Lack of foreign ownership (43) • Distortive effect of taxes and subsidies on competition (66)
Related & Supporting Industries	• State of cluster development (1) • Local availability of specialized research and training services (1) • Availability of latest technology (3) • Local supplier quantity (4) • Local supplier quality (5)	

Source: *2008 Global Competitiveness Report*

Exhibit V: Michigan Employment Breakdown, 1998-2006



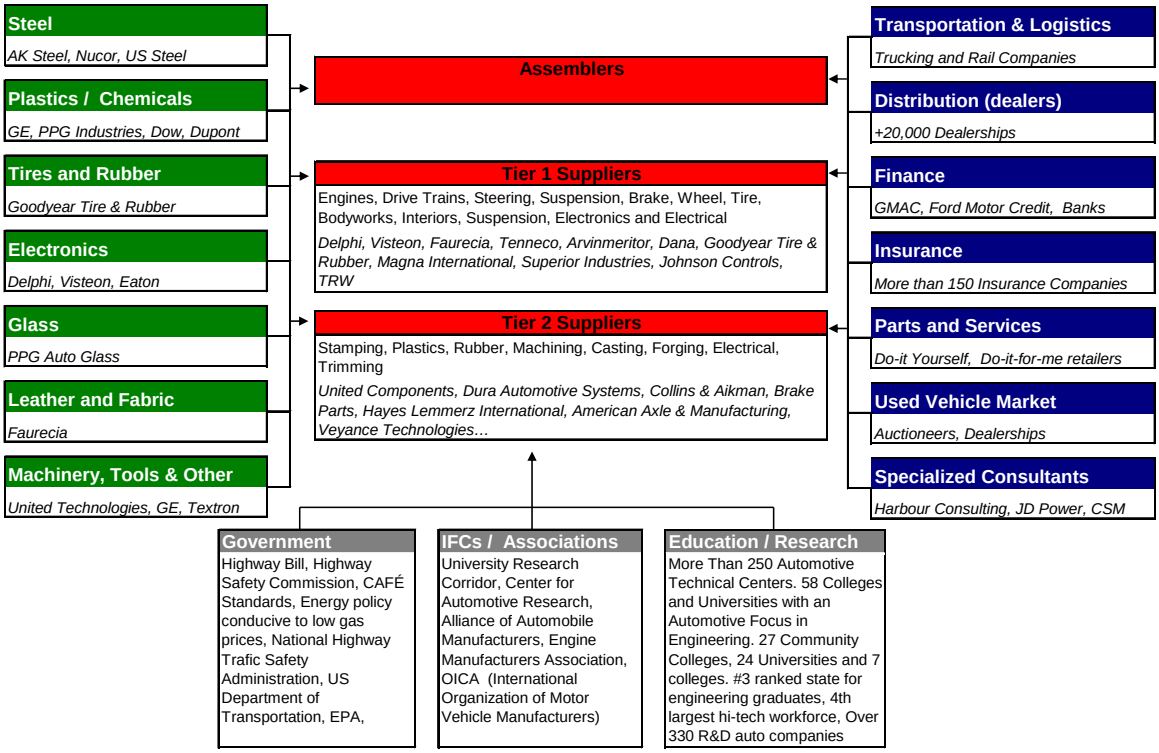
Source: Institute for Strategy & Competiveness, www.isc.hbs.edu, accessed March 2009

Exhibit VI: Michigan Diamond

	Strengths	Weaknesses
Factor Conditions	***Physical*** • Great Lakes location and proximity to Canada • 17 commercial airports, 10 cargo airports ***Financial*** • Ventture Capital availability • Significant R&D funding (# 2nd in overall for industry R&D #11 for academic funding) ***People/Education*** • High school graduation rate of 87% • 131 higher education institutions	***Physical*** • Deteriorating infrastructure from underinvestment ***Financial*** • VC investments of $120mm in 2007 (ranked 25th) ***People/Education*** • 24.5% of population have college degrees, compared to 27% nationwide • Legacy of strong unions
Demand Conditions	• GSP of $382bn, 12th largest state economy	• Average wage below national average • Lowest average wage growth in nation
Context for Firm Strategy & Rivalry	• Home to 33 Fortune 1000 companies • 2nd most business friendly state in nation, • Government focused on diversifying economy • State reduced taxes now in line with US average	• Heavy reliance on automotive • Exodus of educated talent • Limited entrepreneurship • Government selection of clusters
Related & Supporting Industries	• Growth in alternative energy research, particularly solar, wind and alternative battery technology • Life science industry developing around university R&D with 542 companies • Various institutions of collaborations	• Very concentrated clusters in automotive and business services

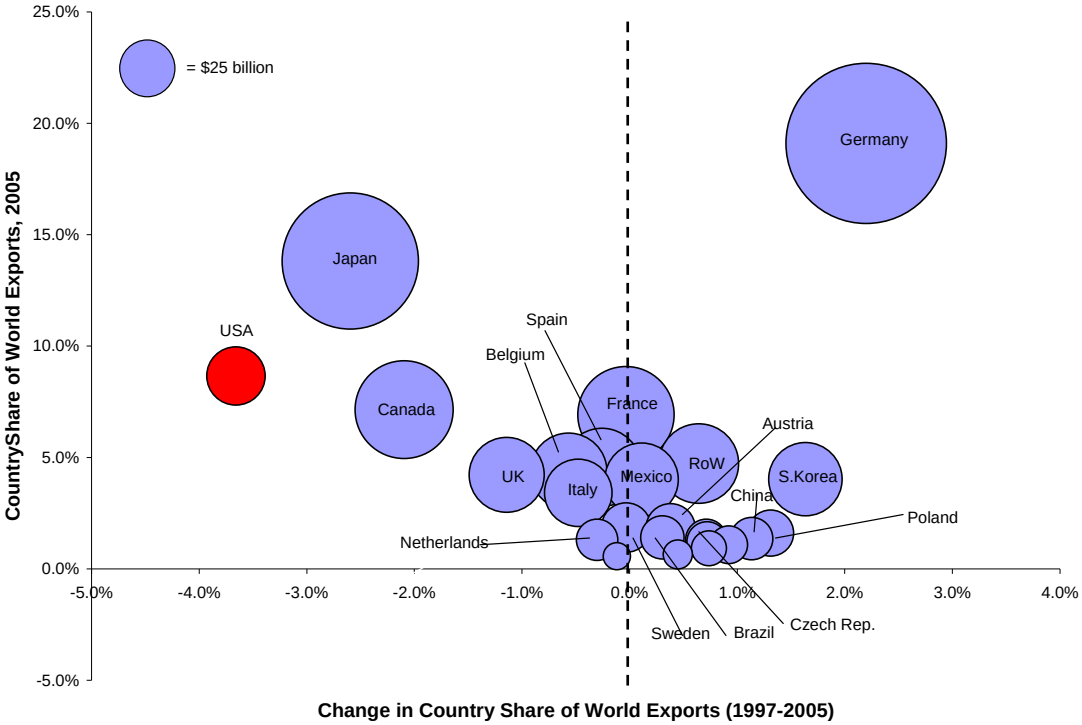
Source: Michigan Venture Capital Association, Michigan Department of Transportation, Michigan Transportation Funding Task Force, U.S. Census Bureau, Michigan Advantage, University Research Corridor, Fortune Magazine, Site Selection Magazine, Institute for Strategy and Competitiveness

Exhibit VII: Michigan Automotive Cluster Map



Source: Expert Interviews, Team revision of Christian Ketels, "Thailand's Competitiveness: Key Issues in Five Clusters", ISC/HBS, May 2003

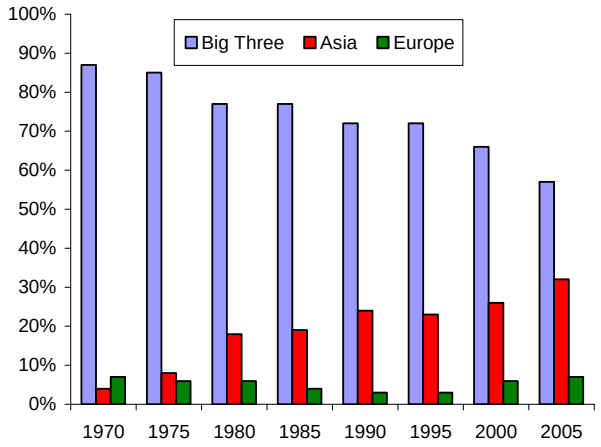
Exhibit VIII: Global Automotive Export Market, 1997-2995



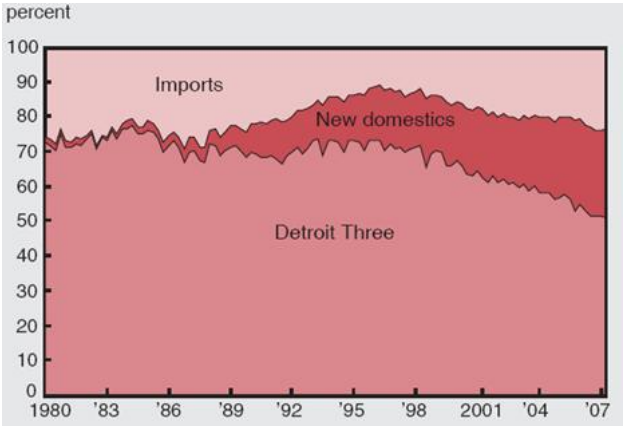
Source: Institute for Strategy & Competitiveness Web site, www.isc.hbs.edu, accessed May 2009.

Exhibit IX: Competitive Dynamics of US Automotive Market

Breakdown of US Market Share

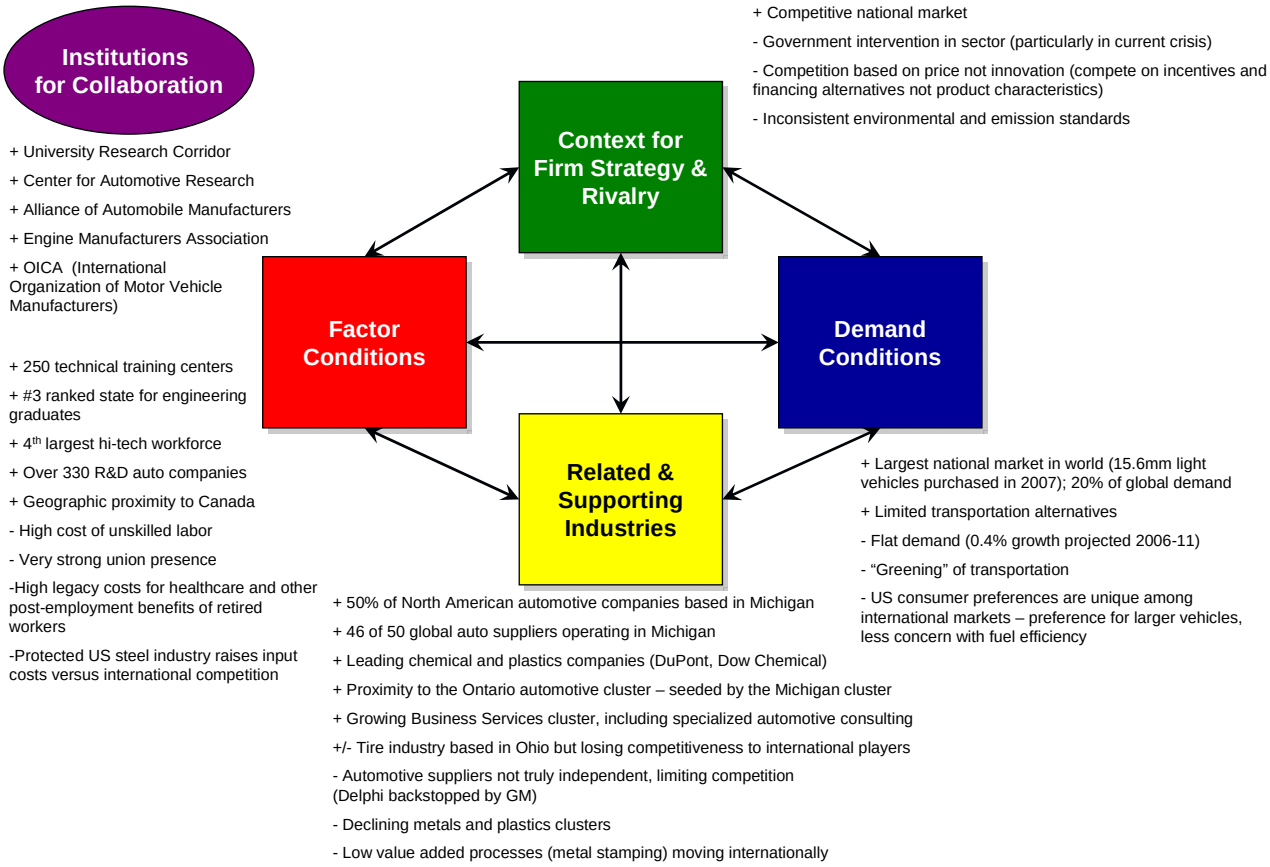


Change in Nature of Competition



Source: Automotive News Market Data Book (1980-2006), Ward Automotive

Exhibit X: Michigan Automotive Cluster Diamond



Source: Expert Interviews, CSM Worldwide, Michigan Economic Development Corporation, Standard & Poor's

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John McElroy, Automotive Expert & Editorial Director, Blue Sky Productions, Inc.
Richard Tedlow, Professor, Harvard Business School
Shaun Yang, Retired Seat Engineer, Ford Motor Company (worked for 20 years)