

# The changing spatial economic structure of the state of Michigan, through 1970-2008.

*Jeroen Bakker, 2011*

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## **Abstract**

This thesis describes the current spatial economic organization of the State of Michigan, under the influence of decentralizing population and employment.

## **Keywords**

State of Michigan, decentralization, commuting patterns, migration, employment, spatial economic organization.

## Summary

The relation of space and economics has proved to be important repeatedly and is a most interesting field of research. This report tries to identify spatial economic structural changes in a region that is undergoing long term economic stagnation and spatial decentralization of population and employment. As this region is distinguished by a relatively large manufacturing industry, the developments in that industry receive extra attention.

The literature review starts out with the history of suburbanization and how this has had its influence on the US. Starting before WWII, the suburbanization accelerated in the 1950s. The decentralization of population was followed by a decentralization of service industry-employment, following its market. Manufacturing facilities have been leaving the central cities for a longer time because of multiple reasons, high land rents and technological change being the most important reasons. The manufacturing-industry is making a geographical shift on a higher scale too. Where it was once concentrated in two or three relatively small areas of the US, it has been spreading over the entire southern part of the US since WWII.

Manufacturing industry is believed to have followed a different path of decentralization, preceding the service-industry for sure, and possibly even the population. The decentralization has changed the urban system that used to be dominated by a central city. The new structure is a network of employment sub-centers that are more equal in terms of employment distribution.

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## Preface

The writing of this preface precedes the actual finishing of my thesis. What started with re-writing a research approach over and over again changed into building a coherent report. The last work is still to be done, but after some months of writing it feels like the end of the project is nearing. That project started one year ago when I was allowed to start preparing for a semester at the University of Illinois at Urbana-Champaign. This opportunity was offered by the NEURUS/ICURD program and enabled me to indulge myself in a completely different culture to gather the data that is the basis of the research in front of you.

My stay in the US was an eye-opener for me in many respects. First, because of the things I've learned from the many friends I met in university residence hall Hopkins, and the other NEURUS/ICURD students I got to know. Traveling through the US has been one of the things I enjoyed most so thanks to my traveling companions too.

Besides good friends, I have met people that were of great assistance in writing this thesis. Ed Feser has put much more time and effort into counseling and guiding the other exchange students and me than we could ever hope for. The seminars in Groningen and Irvine were of great value too, the enthusiasm of the experienced scholars there inspired me and their expertise helped me in writing a decent report. I have also had a lot of help and advice at the Regional Economics Applications Laboratory, where the people were so kind to offer me a place to work, so thanks to Geoff Hewings, Chenxi Yu and all others. I hope I will see you at another game of football one day.

Paul van Steen has also been of great help, through advising on my writings and as head of the international office. Most thanks go to Marjolein who has motivated me time and time again, and helped me to put some structure in this report.

Finally I want to thank you for taking the effort to read this report, I hope it will provide you with some of the information you were looking for or give you something to think about. Please, enjoy the read!

Jeroen Bakker, 2011

# Chapter one: Introduction

This introduction contains information on how and why this research has been conducted. The why-question concerns motivations and practical considerations. The how-question concerns the problem leading up to the research and the goals that are aimed to achieve, and the research-questions that are set up in order to achieve these goals.

## 1.1 Problem

Since the 1930's, a steady sub-urbanization has taken place in many western countries and in the United States in particular. After the Second World War, the sub-urbanization grew even stronger, changing the way cities look and function. It is understood that the spatial economic structure of urban regions is decentralizing, and there is some consensus on what this process looks like (Rothblatt, 1994). The unit of measurement in previous studies of regional and urban economics in the US, such as Zax and Kain (1996) and White (1999) performed, is usually the metropolitan area and the outcome often confirms the diminishing importance of the Central Business District (CBD). The complementary finding is the forming of an urban system with multiple employment-centers (Boarnet, 1994; Garreau, 1992) in the suburban parts of the metropolitan areas.

There is only shallow insight in the new spatial distribution of population and employment, and what this means for the economic geographical structure in terms of functional specialization and commuting patterns remains unclear. This problem is the focus of this research, as this uncertainty is curious in a time where it's academically acknowledged that economic development is not generated on a national, but on the regional level (Barnes and Lebedur, 1998).

The State of Michigan, in the United States, is burdened with some characteristics that make it an interesting case to study the interaction of new employment centers. The state has undergone intense sub-urbanization, suffers from serious economic stagnation, is still struggling with its heritage as a heavy industrial state while the service-industry era has long commenced, and social problems have led to unbalanced central cities and suburbs in terms of income-distribution. Barnes and Lebedur (1998) state the importance of metropolitan areas as the engine behind a regional economy. In the case of Michigan, that could mean that the economic failure of the Detroit metropolitan region holds back the growth of a much larger area. The disputed causality of whether people or jobs lead the sub-urbanization (Steinnes, 1977; Walker, 2001), and the supposedly special role played by the manufacturing-industry, make the State of Michigan an interesting case to study, as Michigan is still a manufacturing state (BLMI&SI, 2011).

## 1.2 Purpose and relevance

This study aims to analyze how the spatial economic structure of a larger area has changed under the influence of decentralizing population and employment, over a time span of several decades. To analyze the spatial economic structure, the economical function of, and interaction between counties in the State of Michigan are examined. A unit of measurement that examines both the dynamics within the metropolitan area as the region around it will be used.

The objective is to better understand the process of decentralization, and the consequences it has for Michigan's regional economy.

The relevance of this study can be found in multiple facets. First, it tests the applicability of some theories in the field of economic geography and spatial sciences in general. Second, an in-depth investigation on the spatial economic structure leads to a better understanding of the State of Michigan, and maybe other states or regions as well. A better understanding can elaborate in more effective or efficient policies for regional development, urban planning and prediction of development. This study may also find what current developments imply for Detroit and other old industrial cities that are now in a bad condition. Finally, this study is likely to find new results that express changes compared to earlier similar studies such as those performed by Fuguitt (1991) and Pisarki (1987).

### 1.3 Research structure

The research is a case study, conducted in the state of Michigan. The period of analysis is 1970 through 2008, because the most important data is available for that time-span. The analysis of the changing spatial economic structure has a descriptive character. Empirical research and theory on this topic, from several fields of spatial research, provides a theoretical framework to anchor this research and hypotheses.

The analysis is performed on a state level, using the county as unit of analysis. The role of history and different circumstances for every region or city is decisive in how it comes to develop. That means there may be many differences between the counties compared to each other. This research generalizes counties into groups to find the larger patterns that impact counties with particular features.

To maximize the utility of this research, an extensive understanding of Michigan's specific socio-economic circumstances is built up. A brief history of Michigan's economic development is also given. This is required to put the findings in context, and see which developments are related to path-dependency (Boschma and Lambooy, 1999; Krugman, 1991). Some findings may be suitable for generalization; others may be specific for the state of Michigan.

The main research question is: *How has the spatial economic structure of the state of Michigan changed over the period 1970-2008 as a consequence of decentralization?*

To answer the main research question, the following sub-questions have to be answered:

1. How has the distribution of population in the state of Michigan changed throughout 1970-2008, and what seems to be the trend in migration and population growth for the near future?
2. Have new employment sub-centers formed in Michigan, and how do these sub-centers relate to the population-centers?
3. Have new specialized sub-centers of employment formed in Michigan during 1970-2008?
4. How have the commuting patterns between Michigan's counties shifted, from 1970-2008?

The sub-questions are placed in an order that builds up from relatively simple analysis to a more in-depth research, and all together they eventually answer the main question.

The first question is designed to open up the research by looking at broad patterns of relocation throughout the state. Exploring population development is a good indicator to locate growth, and is relatively easy because of commonly available data. Population distribution is also important to study, as it determines the location of the market, labor supply, infrastructure and much more.

Question two aims first to find how employment has re-distributed itself spatially, during the period of analysis. The second component of the question aims to find out to what extent less populated or more peripheral counties can be important as employment-centers.

The third question builds further on the findings in question two. Regions that can be identified as employment-centers are likely to differ from each other in terms of specialization. The question tries to sort out what specializations form patterns that are important to the functioning and decentralization of Michigan.

The fourth sub-question has to uncover the current spatial economic structure. By exploring the commuting-flows between counties, we can see how the (new) population and employment-centers interact spatially.

The research-questions just introduced form the red line of this research. Those questions will be answered in chapter six, the conclusions, based on the information that is gathered in chapter five, the analysis. The analysis is done on the basis of three hypotheses, which are unfolded in chapter four, together with the methods that are used. The hypotheses are based on the theory that is analyzed in chapter two, and contextual factors that are considered in chapter three.

Following the short exploration of the structure of this thesis, chapter two examines relevant theory. This theoretic body initially follows the sequence of topics as they are listed in the research questions, with some in-depth research and extensions where necessary. The most important concepts are defined in resemblance to previous research, to keep consistency throughout the case study, and so past studies related to the subject can provide additional and supporting information for this study.

Chapter three starts to dig into the relevant context, and examines the research area. A brief introduction to Michigan's socio-economic history, and some geographic and demographic characteristics of the state lead up to the current state of Michigan's economy. To put Michigan's economic performance in context, it's compared to the rest of the United States using a swift but comprehensive analysis.

Chapter four starts unfolding the analytical part of this report. To operationalize the research-questions, three hypotheses are defined. These hypotheses are distilled from the theory and context chapters, and form the backbone of the analysis, chapter five. Chapter four also explores the data and methods that are used to test the hypotheses. This means computation of the data through tables and statistical tests, and analysis of spatial patterns through maps created using Geographical Information Systems (GIS). Chapter five is finished by a discussion of the results, and the consecutive approval or rejection of the hypothesis.

The final chapter of the research, chapter six, deals with the answering of the research-questions and an analysis of the research itself. The first part consists of a review of the research-questions and the answers that were found, leading to some conclusions. The second part means an evaluation of the data and research methods used in this research. Potential research that could succeed this research concludes the report.

## Chapter two: Theory

This chapter handles previous research that has been consulted to shape this research. It has been used to get a better insight in the problem, define key definitions, formulate hypotheses and finally make sense of the eventual results. The decentralizing American cities have been under the attention of economists, urban planners, geographers, sociologists and other scholars. The first paragraph concerns the process of decentralizing population, as the US has experienced it over the last century. The second paragraph analyzes literature on the decentralization of employment. As there is a strong relation between the two, the third paragraph goes into the causal relationship of the two forms of decentralization. It turns out there is a special role for the manufacturing-industry, so a paragraph is dedicated to study this sector. Finally, the role of government policy in relation to this topic is briefly discussed, and then the most important findings are summarized.

Mack and Schaeffer (1993, p125) note: “Decentralization of an economic activity at one scale may result in centralization at another. For example: A shift of employment from smaller metropolitan areas in a highly developed region to the larger metro areas of a less developed region is decentralizing in the inter-regional sense, and centralizing in the national context because of the movement to a higher order city.”

Also, the process of decentralization brings forth a question of momentum, or a tipping point. The point is that agglomerations continue to benefit from their agglomeration economies until diseconomies start to develop (McCann, 2001). From that point on, economic activity might look for a different place to settle, setting a process in motion that shifts the market's point of gravity to another location (Krugman, 1991). This might explain some of the processes seen in Michigan.

Under the title of “Global, Social and Economical Influences”, Rothblatt (1994, p. 514) discusses the decentralization of urban areas in the US in comparison to Western Europe, Japan and Canada, and finds the pattern has been clearly documented everywhere. He discusses the terms concentration and centralization interchangeably, which doesn't bring this discussion any further in that sense, but he does bring forward some interesting ideas about the centralization and decentralization of cities on a larger time span.

Carlino (1985) defines “spill-over” from metropolitan areas to non-metropolitan areas as decentralization. When decentralization is occurring, “The forces that gave rise to the metropolitan area still operate, only now their field of influence is wider.” (Carlino, 1985, p. 16). De-concentration is another matter: “With deconcentration, population and employment become more uniformly distributed over space, suggesting the centripetal forces have weakened.” (Carlino, 1985, p. 16). He defines three patterns of de-concentration:

1. Non-metropolitan counties are growing faster than metropolitan ones.
2. The smaller the non-metropolitan place the faster its growth is likely to be.
3. Smaller SMSA'S (Standard Metropolitan Statistical Area's) are growing relative to larger ones.

As these definitions are devised in a research similar to this one, and cover the required subjects and units of measurement of related research too, they will be used in the rest of this thesis.

## 2.1 Decentralizing population

As the industrial cities of the 19<sup>th</sup> century became congested and polluted, the affluent middle class sought for a way of living that met their preferences. In the US, according to Fishman (1996), people followed the example given in England as early as the end of the 18<sup>th</sup> century, to live beyond the edge of the existing city, in newly formed suburbs. Enabled to do so by first the streetcar and then the car to commute to the central city, the suburb became an ideal(ized) place to live. “Though physically separated from the urban core, the suburb nevertheless depends on it economically for the jobs that support its residents.” (Fishman, 1996, p. 22). He further defines suburbs as including middle class residences, and excluding all industry, most commerce except for enterprises that specifically serve a residential area, and all lower class residents (except for servants). The building of houses for the fast growing middle class was much easier on the outskirts of the city than it was in the already built up area of the central city, and proved a good investment. According to Fishman, shopping and offices came into the suburbs from the 1920s and 1930s and onwards. That is an early point in time in comparison to other literature (Garreau, 1992; Edmonston and Guterbock, 1984), but sequence of events indisputable.

The sub-urbanization of American population has exploded in the 1950's and it has continued to do so for a long time. In 1984, Edmonston and Guterbock find reasons why the de-concentration is supposed to slow down eventually, other than the logical depletion of population in central cities. Amongst others, rising transportation costs as a result of higher gas prices, diminishing income growth and changing household structure and size are some of the factors that should have slowed down sub-urbanization throughout the last decades. Their study finds that the speed of population de-concentration has not slowed down at all, and the reason seems to be that activities as work, commerce and entertainment have caught up with the de-concentration, making people less dependable on the city center, a finding that is confirmed by Jordan et al. (1998).

This phenomenon has been described by several scholars under different names. Fishman (1996) called the new urban form “technoburbs”: “[...] the simultaneous movement of housing, industry and commercial development to the outskirts has created perimeter cities that are functionally independent of the urban core. In complete contrast to the residential or industrial suburbs of the past, these new cities contain along their superhighways all the specialized functions of a great metropolis – industry, shopping malls, hospitals universities, cultural centers, and parks.” (Fishman, 1996, p. 29). New transportation and communication technology is believed to make this urban form possible. The edge cities, as described by Garreau (1992) support Fishman's theory, more on that in the next paragraph.

A phenomenon that is related to suburbanization is called “white flight”. This refers to large numbers of white residents, usually middle class, that leave the central city to live in the suburbs, starting after World War II (Frey, 1977). Apart from the desire to live in a bigger house, negative associations with the black population are another supposed reason to have caused white flight. As the homes that were left behind were being filled up by black in-migrants that came in from the rural south of the US, the process reinforced itself. Frey (1977) reports that during the 1960s and 1970s, the large central cities started to receive immigrants from a more diverse racial background and higher status, mixing with a population that either preferred living in the central city, did not mind living in racially mixed areas or could not afford to migrate to the suburbs. This led the white flight as a consequence of racial motives to wind down in the decades after it peaked in the 1950's, but economical motives grew stronger as the economic condition of the central city deteriorated.

As the affluent part of the population left the central city, many jobs did too. As they settled down in

independent political areas beyond the central city (Zimmer, 1975), the city had to sustain more facilities and services than feasible on the ever-shrinking tax-base. As suburbs don't have to provide a lot of facilities they can suffice with lower tax-rates, drawing even more people out of central cities (Frey, 1979).

The suburbanization brought all kinds of socio-economic problems to the central cities (Douglas Carroll, 1952), and society as a whole. For example, in 1968, Kain discusses the issue as a social problem, and finds that discrimination on the housing market made it very difficult for the black part of the population to find living space in the suburban areas where employment can be found. He finds that the jobs that were held by the black part of the population are decentralizing, but that these people are not moving with them, resulting in a rising unemployment.

The location of people in an urban area is not the only important determinant in how a city functions. The kind of people living and working in a city influences its production too. The ability to attract or hold on to talent determines the innovative capacity, which in turn determines competitiveness (Porter, 1998). Florida (2003) describes how US cities' capacity to innovate is strongly related to the composition of their population. He argues that creative capital is generated by a city's creative class. Besides a creative core of professors, architects, designers etc., the creative class consists of creative professionals. A creative professional has a knowledge-based occupation and uses his creativity to solve specific problems. A greater share of gay or bohemian people in the community indicates a larger creative class, which is strongly related with high innovation and high-tech industry rankings. Places with open networks, where newcomers are welcome and loose contacts and weak ties are common, encourage interaction and stimulate innovation.

Fig. 2.1 shows Rothblatt's (1994) constructed scheme through which metropolitan areas are believed to develop over many years. First the area goes through a period of centralization, in which the central city benefits from agglomeration economies and consumes all of the area's resources and labor. Then, diseconomies of scale such as pollution, congestion and high land rents in combination with trickle down effects cause the surrounding area to grow.

Type	Stage	Population Change Characteristics		
		Core	Ring	Metropolitan Area
1	Centralization	+	-	+
2	Absolute Centralization	++	+	++
3	Relative Centralization	+	++	+
4	Relative Decentralization	-	+	+
5	Absolute Decentralization	-	+	-
6	Decentralization	-	-	-
7	Reurbanization	+	-	+/-

Fig. 2.1. Model of metropolitan development changes. (Source: Rothblatt, 1994)

Since America's metropolitan areas are now in a process of decentralization, this schedule implies that in some point in the future, the city's core would gain population again at the expense of the ring, and the whole metro area would remain stable. In this phase, the area re-urbanizes "by expanding high density core areas along transit corridors in the largest central cities and restraining automobile infrastructure." (Rothblatt 1994, p. 515). He believed the US cities were functioning around phase 5, possibly accelerating the decentralization process under the influence of a more open and competitive global economy.

Carlino's (1985) research supports long term growth patterns like this. Although he measures employment growth instead of population growth, a clear pattern is visible. Table 2.1 shows how the larger and older metropolitan areas in the Northeast and North Central parts of the US show much smaller growth than the smaller metropolitan areas in those same areas. At the same time, the larger metropolitan areas of the southern and western part of the US, which are relatively young, are still showing strong growth. This is part of a more general movement of population from the so-called Rust Belt to the Sunbelt, or from the northeastern and mid-western parts of the US to the south and southwestern parts. "In 1940, 49 percent of the nation lived in the New-England, Middle Atlantic and East North Central divisions. By 1990, this area's share has fallen to 37%. (Kahn, 2000, p. 569).

**Employment Growth by Metropolitan Size  
and Major Region: 1969 and 1979**

	Percentage change of employment				
	Total	Northeast	North Central	South	West
Metropolitan	31.5	9.1	23.2	51.3	58.0
Over 3,000,000	14.7	2.1	15.8	82.7	30.9
1,000,000 to 3,000,000	41.9	15.2	23.8	53.8	78.0
500,000 to 1,000,000	33.1	15.0	19.4	46.6	91.5
250,000 to 500,000	41.6	19.0	33.3	48.7	79.9
Less than 250,000	42.3	23.1	33.3	49.1	101.9

Table 2.1: Employment Growth by Metropolitan Size and Major Region: 1969 and 1979. (Source: Carlino, 1985)

## 2.2 Decentralizing employment

A large body of theoretical argumentation is written on the matter of distribution of employment over a region or over places, and why the distribution is not homogeneous. Traditionally, small places have a highly specialized economical function, whereas large cities have a more diversified economy. This is partly explained by market areas. A small place will hold several services that are used frequently, and therefore only require a small market. Bigger places have a bigger market, and can therefore sustain many more services. Another reason is that small places usually only have a small export base. As bigger places have a more developed labor supply, they also attract more advanced economic activities than small places do, which also contributes to their economic diversity (McCann, 2001). Some smaller places may hold almost no employment, but instead have their income via elderly residents who live of their pensions.

Effects as these have given larger places benefits compared to smaller places, known as agglomeration economies. One of the results is known as the hierarchical diffusion of knowledge, a theory that can be related to the product life cycle. This theory distinguishes several phases in a products life, all marked by particular characteristics. The initial phase is related to a lot of research, knowledge intensive work and high costs per produced unit. As the product becomes more common, the production-process is blueprinted and often off shored to a cheaper location. The relation this has to regional economies is where a region or place stands in the hierarchy. A big place has the knowledge and skills to sustain the knowledge intensive research and high-level decision making, where a small place has to sustain itself with the less profitable production work (Vernon, 1966). This can be seen back in practice, as Fuguitt's (1991) study for example showed that higher educated, paid and more sophisticated occupation workers tend to commute toward areas that hold a lot of jobs.

Cities in the US, Europe and the rest of the world have long been marked by a mono-centric form, in which the city center played the most important role in terms of residence, employment and business. As just discussed, the residential role of the central city has been diminishing for a long time already, at least in the US. More recent research shows that the role US central cities play in terms of employment is not as important as it once was either. Anas et al. (1998) point out that many cities have seen their employment being spread out over what they call sub-centers.

Anderson and Bogart (2001) find for metropolitan areas that their centers hold only 10-27% of the employment, not enough to be speaking of a mono-centric city. Even when the employment located in all those metropolitan areas sub-centers are added up, they all account for 31-52% of the employment in each respective metropolitan area, with similar percentages reported by Anas et al. (1998) for even more cities. In the observed cases, the old city center does not have a dominant role over the sub-centers any more.

Glaeser and Kahn (2001) support these findings, and point out that the mono-centric city model may have perished a long time ago. They find that in 1950, 50% of the employment was outside the largest county of each metropolitan area. They also conclude that in some cities, the suburbs look a lot like the central cities they are connected to, in terms of employment density. Based on the spread of employment over the suburbs, they conclude it would be better to speak of it being decentralized instead of poly-centered, which seems to be in line with Anas (1998) and Boarnet's (1994) studies, that find that all employment sub-centers together usually only hold 50% of the employment.

Earlier research similar to this thesis has been done by Fuguitt (1991), who also studied commuting between counties on a hierarchical classification, in a study that considers the relation between commuting and settlement structure. His research focuses on different commuting behavior between subgroups, distinguished by gender, education, income and occupation. By occupation he defines two groups, production services and manufacturing, which is interesting in relation to the case of Michigan. In a spatial sense, the research aims to find the direction of commuting streams through the hierarchy of size-of-place-groups, which yields some interesting results.

Based on nationwide 1980 census data Fuguitt (1991) finds that workplaces were still a lot more centralized than residence places and that more than 75% of the population still lived and worked in metropolitan areas. The general finding is that people commuted to a place of work that was located in a bigger place than where they were living in. For example: two thirds of the commuters traveled between the center of a metropolitan area and its ring, the vast majority working in the former and living in the latter. The majority of those commuting between non-metropolitan and metropolitan areas also had their job in the metropolitan area. Even cities in non-metropolitan areas have their own hinterland consisting of the rural areas surrounding them. Of two exceptional findings, the first is that higher-status workers that live in non-metro areas do not commute to bigger places. Secondly, in contrast with other workers in metropolitan areas, those employed in manufacturing do not commute toward the central cities. This implies a stronger decentralization of manufacturing industry than other industries.

In 1991, Fuguitt did not note the fact that most commuting was either within metropolitan areas or within non-metropolitan areas, and not much between the both as exceptional. That is likely because of a bias in classification, as a metropolitan area is defined by incorporating all counties that have strong commuting relationships. In geographically large metropolitan areas, the data shows residents of the ring area whom are not working in the central city are likely to work in nearby non-metropolitan cities, which might be an early indicator of a new urban form, called the edge city (Garreau, 1992).

The edge city is a well-known concept concerning the changing form of urban areas in the US. He has a sharply defined view on the phases in which the edge cities have developed. Initially, the suburbanization that took off after world war two started the spreading out of the population. The second phase is the “*mall*ing” of the country: because people got tired of driving downtown for their shopping, so the malls came out into the suburbs. Only in the third and last phase, the jobs followed, making the edge cities largely self-sustainable city-centers, making it unnecessary for residents to leave for the central city in everyday life. From this point on, the edge cities started to dominate the American urban scenery. The definition of an edge city is a place that holds a minimum of office space and retail space, more jobs than bedrooms, is perceived by the population as one place and was nothing like a city 30 years ago (Garreau, 1992).

Garreau limits the relevant employment to office-jobs, as they are on average in eighteen-fold higher densities than in manufacturing. As manufacturing-industry usually has one employee per 4,500 square feet, he supposes a cluster of manufacturing-industry cannot generate enough employment to start an edge city. Bingham and Kimble (1995) study the industrial composition of edge cities and downtowns in Ohio. Their results show that the industrial composition of edge cities doesn't resemble that of the central city they are adjacent to, and that none of the edge cities resembles the average composition of all edge cities either. All edge cities have their own specializations, usually strongly diversified with seven of the edge cities in this case study even have substantial manufacturing clusters. Another result is that it is the edge cities where the job-growth is occurring, where central cities are losing jobs or are at best stabilizing. These results do reinforce Garreau's suggestion that the edge cities are highly independent from the central cities they spun off from.

Elaborating Garreau's theory of edge cities is Wheeler's (2001) study of spatial correlation between the growths of economic activity in US counties. He finds a strong correlation up to forty miles distance that drops sharply thereafter, to reach zero after two hundred miles. This is consistent with the rule of thumb that the maximum commuting time is forty-five minutes, implying that businesses and their employees are within this range of each other, and also implying that growth of one county can be of influence on neighboring counties.

The eventual arrival of jobs in suburbs brought about a change in mobility patterns. Kahn (2000) finds that suburban residents drive an average 31% more than people living in central cities. Other research finds commuting times are believed to have dropped (Gordon et al., 1989). However, employees still live in other suburbs than where they work, and during the 1980's, the suburb-to-suburb commute became the most common commute-type in the US (Pisarki, 1987).

Anderson and Bogart (2001) share the opinion that sub-urbanization and decentralization is not a random process. They find strong evidence that within three metropolitan areas of 2-2,8 million inhabitants in the same area as Michigan, the employment is distributed over the sub-centers in order of the rank size rule (Zipf, 1949). Deviations from this pattern can be explained by involving the physical restrictions each city endures in terms of limited area that can be developed (Rusk, 1995). Cities that are highly constrained by either area that is already built upon or by planning restrictions do not apply to the rank size rule.

Another observation Anderson and Bogart (2001) make is that intersections of interstate highways almost always have employment centers next to them, and that all employment centers have at least one interstate highway nearby. They also find clear evidence that the employment sub-centers have one or often more specializations. These specializations are important, because a non-specialized group of firms loses agglomeration benefits like a locally skilled labor market and specialized suppliers. The downtown areas are still specialized in communications and public utilities, public administration and

finance, insurance and real estate. This is because of the need for face-to-face contact, but also because the related government functions and communication infrastructure are historically centered in the downtown area. “Both the infrastructures themselves and the employment needed to operate and maintain them remain focused on the downtown.” (Anderson and Bogart, 2001, p.158).

### 2.3 Causality

A discussion concerning the process of decentralization is the order in which population and employment decentralize. Rothblatt (1994) for example takes for granted that industrial and commercial activity followed residential development. So does Garreau (1992), in his view it even took commercial activity about three decades to follow into the edge cities.

White (1999) summarizes some incentives for firms to decentralize. First, a firm can pay lower wages, which workers accept because they have to commute less. Secondly, land prices are lower, although that is also to the extent how relatively central in the suburb the employer wants to be located. Thirdly, some firms may prefer a location outside the city center as it is less congested, usually still connected by at least one interstate highway and maybe closer to a hub like an airport too. Finally, more a facilitating fact than an incentive but not less important is the advancing technology in the field of information and communication technology. As stated before, some firms still rely on infrastructure, face-to-face contact and networks of institutions that can only be found in the central city, which makes this story irrelevant to them.

In 1977, Steinnes performs statistical tests to determine the direction of causality between decentralizing population and employment. He documents not every form of economic activity has the same relation with suburbanizing population. Thurston and Yezer (1994) also find that industries have to be distinguished in the study of decentralizing employment. Using disaggregated industries, they find a significant negative effect of manufacturing industries in relation to population density, and a significant positive effect of service and public utility, and retail and service sectors on the population density. Five other industries have no significant influence.

Also in 1994, Boarnet tests the mono-centric city model assumption that employment is an exogenous influence to intra-metropolitan population location. His results suggest that “[...] employment changes within an urban area depend on population changes in a surrounding labor market.” (Boarnett 1994, p. 93). He claims this is broadly in line with what other authors have studied in modern urban development. An employer that needs a lot of labor would like to move to a suburban location, as that enables him to pay lower wages. However, that only works if commuting distances are short; otherwise commuting costs have to be compensated. Therefore, the employer would move his business to a place where laborers are abundant, so jobs follow people.

Summarizing studies of Steinnes (1977), Thurston and Yezer (1994), and Boarnet (1994), White (1999) concludes that employment follows population. Manufacturing industry is presumed to hold a special relation with suburbanization in terms of causality, preceding it instead of following. Another feature interesting to this study is the strongly decentralized urban structure that is commonly associated with areas where manufacturing industry is abundant.

In that light, Walker’s (2001) conclusion that decentralizing manufacturing has shaped the city (San Francisco in his case study) is not so surprising. He claims lower land prices, better infrastructure and speculation were reason for this development. It must be noted that the period he studied is 1850-1940, but it is very well possible that the foundations for later development in other metropolitan areas have been laid in this era too.

Glaeser and Kahn (2001) think decentralizing employment is a result of residential preferences, and the human capital level involved per industry. As a result thereof, manufacturing is the most decentralized industry, and services are least decentralized. A final argument put forward by Glaeser and Kahn (2001) is that service-industry “products” are more expensive to transport, causing the industry to cluster. Their empirical research find that cities with a lot of manufacturing industry tend to spread out. Florida (2003) finds that the group of people, that is responsible for most innovation and the founding of innovative firms, has strong preferences for open-minded cities, offering the opportunity to express their lifestyle. The place where they choose to live determines where they start their business, so in this light, employment follows the choice of residence.

The controversial role of manufacturing may be explained by looking at the case at a higher scale-level. Carlino (1985) hypothesizes that technological innovations have led agglomeration economies for metropolitan manufacturing to decline, resulting in de-concentration of manufacturing firms. Using County Business Patterns data for all US counties, Carlino places the development in a longer time-span, showing how non-metropolitan counties have caught up with employment growth during 1959-1969, and even reached higher growth in the ten years thereafter. Table 2.2 shows how non-metro counties that were not adjacent to metropolitan counties even reached the highest growth rates of all.

	1951–1959	1959–1969	1969–1979
<b>Total</b>	14.3	35.7	34.4
<b>Metropolitan</b>	16.5	35.1	31.3
<b>Nonmetropolitan</b>	9.5	36.9	41.0
<b>Adjacent</b>	9.7	37.4	38.2
<b>Nonadjacent</b>	9.4	36.3	44.5

Table 2.2: Percentage Change of Total Employment by Type of County. (Source: Carlino, 1985)

It may seem that the non-metro counties held a smaller number of jobs than metro counties, making it easier for those to achieve higher growth rates, but table 2.3 and 2.4 tell a different story. First, table 2.3. shows that it was the manufacturing industry that really kept up the growth level in non-metro counties, especially relative to the metropolitan counties that saw almost no growth of manufacturing employment during 1969-1979. Again, the non-adjacent counties experience the strongest growth, strengthening the expectation that manufacturing was not making its way to the fringes of the city, but out of the city.

	1951–1959	1959–1969	1969–1979
<b>Total</b>	1.0	26.4	8.8
<b>Metropolitan</b>	0.1	21.4	2.6
<b>Nonmetropolitan</b>	3.1	37.5	21.0
<b>Adjacent</b>	2.0	36.3	18.3
<b>Nonadjacent</b>	4.9	39.4	25.0

Table 2.3: Percentage Change of Manufacturing Employment by Type of County. (Source: Carlino, 1985)

Table 2.4 shows the changes in employment in absolute numbers, making it clear that also in non-metro counties, a serious number of jobs is concerned.

Change in Employment, 1969–1979 (in Thousands)		
	Manufacturing	Total
Nonmetropolitan	838	4,191
Adjacent	436	2,182
Nonadjacent	403	2,008
Metropolitan	420	14,121

Table 2.4: Change in Employment (in Thousands). (Source: Carlino, 1985)

Figure 2.2 gives some large industries as illustration of the decentralizing industries. It shows manufacturing is without doubt the driving force behind the employment growth in non-metro counties. On the other hand, the table shows how non-metro experience relatively diminishing employment in retail, finance and service industries. This employment growth is largely absorbed by the edge-cities, as was reported by Garreau (1992), and Bingham and Kimble (1995).

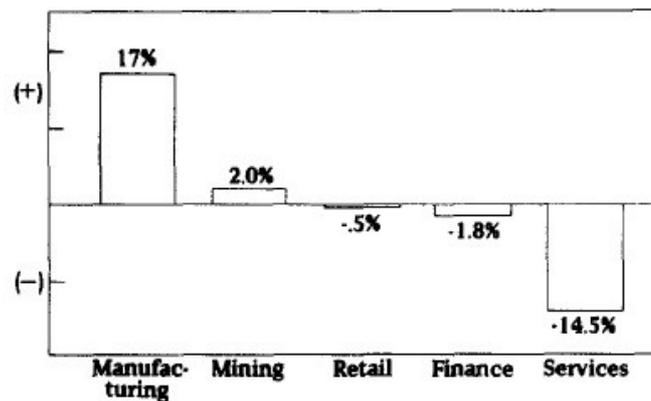


Fig. 2.2: Growth of large industries in Non-Metropolitan areas. (Source: Carlino, 1985)

Carlino's (1985) results, in combination with the established fact that population was moving from non-metropolitan to metropolitan areas up until the 1970s (McCarthy and Morrison, 1977), form strong evidence for what he calls the turn-around phenomenon. The reason for manufacturing to go out of the city consists of two lines of development that together reduced the pull of agglomeration economies. First, changing manufacturing techniques, such as the assembly line, required a lot of surface that was very expensive in central cities. Other innovations led to less required skilled labor, and lightweight materials reduce the incentives to produce next to the market. Changing transportation and communication technology is the second cause according to Carlino. Railroads are not important to most companies any more since almost all transport happens by truck, making firms more footloose. Improved communication technologies removed the need to be close to the management downtown. The effect of these developments, in combination with lower wages in rural counties, has been amplified by the federal highway program, making it cheaper for firms to distribute their goods and attract workers from more distant places.

## 2.4 Manufacturing

The location of manufacturing-industry in the region has changed within the US, and over its borders. When manufacturing became important around the turn of the 19<sup>th</sup> century, it was located in the central cities where it could rely on a large amount of workers that lived nearby. Also, manufacturing was clustered in three regions in the US, both near the necessary resources and near large markets. Holmes and Stevens (2004) note that this situation has changed drastically in two ways. The first change is the location of manufacturing plants relative to the city. Plants have left the central cities as the product cycle (Vernon, 1966) of manufactured goods matured. As skilled labor, short ties to the management and external economies were no longer needed; the manufacturing plants were relocated to more rural areas, in search of lower wages (Mack and Schaeffer, 1993). Holmes and Stevens (2004) illustrate this by dividing the US in four quartiles by population density, each part containing a quarter of the total US employment. The Location Quotient (LQ) for manufacturing diminishes from 1,18 in the most rural quartile to 1,13 and 0,93 in the intermediate zones and finally 0,76 in the most urbanized quartile.

The second change is the “de-clustering” of manufacturing plants, as can be seen in fig. 2.3. and fig. 2.4. In 1947 the manufacturing belt still held 70% of manufacturing employment, this dropped to 38% in 1999. Although the manufacturing belt still holds a large number of plants, it has relatively lost its leading position. The Piedmont region and California region have increased their share in the same time, from 8,4% to 12% and from 3,7% to 7,5% respectively.

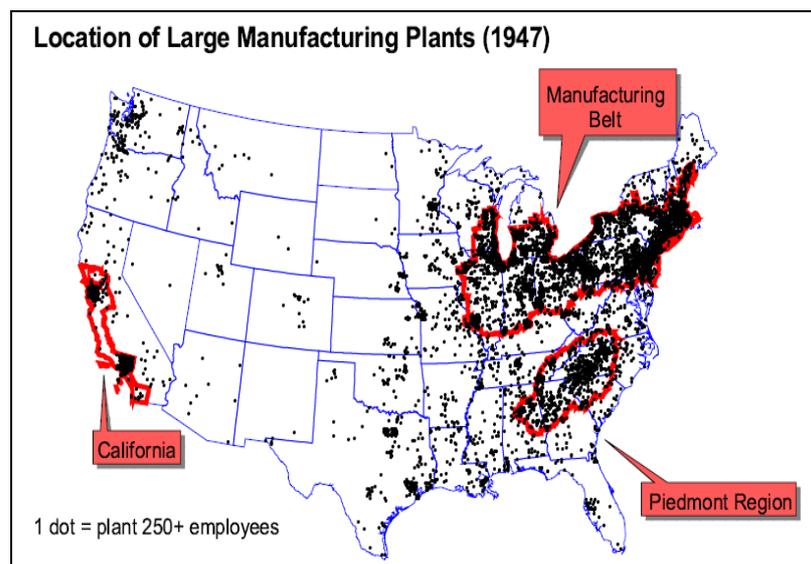


Fig. 2.3: Location of Large Manufacturing Plants (1947) Source: Holmes and Stevens (2004)

These increases are not very impressive, but it does show that the de-clustering of manufacturing hit the manufacturing belt exceptionally hard. The new large plants that were added from 1947 to 1999, which were only about 2000, have largely been absorbed by southern states that have strongly increased their small concentrations from 1947, and growing concentrations in the prairie states (Holmes and Stevens, 2004). This is partly due to all kinds of policies designed by southern states to actively attract manufacturing-industry related employment. The related numbers for 1969-1979 are gathered by Carlino (1985), and are shown in table 2.5. Manufacturing Growth (MFG) is -12,3% in the Metropolitan counties of the Northeast region, and -3,9% for the adjacent non-metro counties there. The North central region is still doing fairly well, while the south and west experience a boom in manufacturing and total employment growth.

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**Percentage Change of Employment Growth by Type of County and Major Regions: 1969 and 1979**


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	U.S.		Northeast		Northcentral		South		West	
	Total	MFG	Total	MFG	Total	MFG	Total	MFG	Total	MFG
Metropolitan	31.3	2.6	9.7	-12.3	23.2	-0.7	51.3	17.5	58.0	26.7
Nonmetropolitan	40.9	21.0	24.3	-0.6	36.6	19.6	42.2	25.6	71.0	50.0
Adjacent	38.2	18.3	20.5	-3.9	31.7	14.9	43.1	25.1	74.2	73.2
Nonadjacent	44.5	25.0	31.1	8.1	43.3	29.5	41.1	26.2	68.1	27.1

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Table 2.5: Percentage Change of Employment Growth by Type of County and Major Regions: 1969 and 1979. (Source: Carlino, 1985)

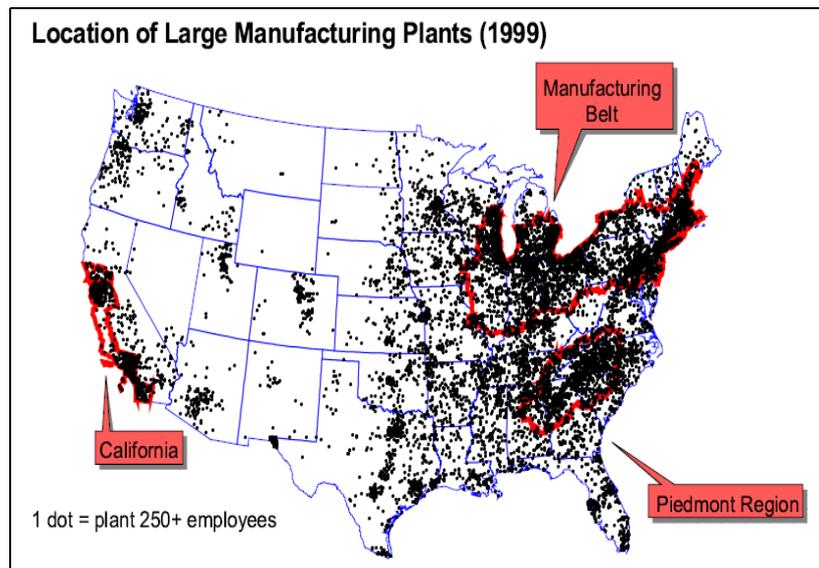


Fig. 2.4: Location of Large Manufacturing Plants (1999) Source: Holmes and Stevens (2004)

Finally, the US are losing their manufacturing plants as a result of the New International Division of Labor (Mack and Schaeffer, 1997). As a result of more strict environmental regulations, increasing land rents and a never-ending search for lower wages, multinational corporations have been taking their production to developing countries. This movement was possible because of improving information and communication technology and lower transportation costs.

A curiosity concerning the manufacturing industry in the US is the relation between wages paid in a specific industry and the geographical concentration (Holmes and Stevens, 2004). High-pay manufacturing activities, such as the production of guided missiles and petrochemicals are highly concentrated, and so are the low-pay industries such as textiles. Industries of medium pay-level are not as concentrated, making a peculiar U-shape of concentrations.

A mismatch between the place of work and the place of residence might exist, which is a serious problem for those who cannot afford to either move or commute. In the early industrial cities, high-density small housing provided a cheap roof for factory workers who could afford nothing more. Now, those who could afford it have left the city and moved out and are now living in the suburbs or the edge cities. As noted, employment also left the central cities. The obvious conclusion is that the central cities are left with those who are trapped in unemployment and poverty.

## 2.5 Government policy

With the outward movement of residential areas, commercial and industrial functions – whichever went first, the electorate's point of gravity did shift from the central city to the suburbs. This means regional governments may not have been as pre-occupied with the central cities downfall as may be expected, knowing the scale of the problems. The idealization of the suburban American lifestyle during the cold war period is an extra justification for lacking attention during that period. Another point that deserves attention here is the different American context. The American society is used to a system that accepts winners and losers, where most (western) European countries would have directed money and policies to areas that are having social or economic problems. Seen in the context of planning, the American government is not as involved as European countries either. On the other hand, the influence of any policy to counter sub-urbanization is estimated to be very ineffective by Jordan et al. (1998). They modeled the effect of a policy that made suburban housing relatively 10% less affordable, and this would have slowed down sub-urbanization in the average metropolitan area from 8% to 7,8%. A central city focused public transit system that reduced commuting by car with 10% would have slowed sub-urbanization down from 8% to 7,6%. Interestingly, Kahn (2000) points out how policies as mortgage interest deduction, highway construction and cheap gasoline have encouraged suburban growth. Estimated results when these policies are canceled are unknown. However, as more and more of the voters are benefiting from these policies, it's highly unlikely that they will change.

Some policies are of direct influence on the location choice of firms, and therefore indirectly on urban structure. The first is regulations concerning the environment. At the federal level, regulations have been put up that are effective in all counties that have not specifically decided they don't want to be under these regulations. Research has shown that polluting industry is moving away from counties that do obey to these regulations (Holmes and Stevens, 2004). Some states and counties have all kinds of policies to attract industries too, especially manufacturing. Tax incentives and subsidies are among the more common policies, but hostilities towards labor unions and the passing of right-to-work laws is also known. In an earlier study, Holmes (1998) measures the levels and growth rates of manufacturing industry at the borders of states with or without “pro-business” laws. He finds relatively large influences of these policies, so these policies may be part of the explanation for the big move south that manufacturing-industry has shown the last decades.

## 2.6 Summary

Reviewing this chapter the most important facts are highlighted here. We have seen the continuing decentralization of population, a process that is accompanied by some socio-economic problems that lead to a troubled state of the central cities. Sub-urbanization and technological advancement have led to the decentralization of employment which, all together, has led to a fall of the mono-centric city model. The new urban form that has replaced it is subject of discussion. It may be poly-centric, but it may also be a more spread-out urban form. New concentrations of employment are usually found to be specialized in several industries, and experience on-going employment growth. Suburb to suburb commuting has become very common. Policies aimed to counter further decentralization are estimated to be ineffective. Manufacturing industry is found to decentralize before population, in contrast to service industries. It is also associated with a strongly decentralized urban structure. Some new employment concentrations have manufacturing clusters as specializations. High and low tech manufacturing industries have been found to cluster more than medium-tech ones. The manufacturing belt is loosing a lot of it's manufacturing employment to other parts of the US. The US as a whole is losing manufacturing employment to countries that are able to produce for lower wages.

## Chapter three: Context and research area

As this research is set up as a case study, a comprehensive understanding of the context is required to put the eventual results in perspective. This chapter combines data from various sources to understand Michigan's spatial, demographic and economic context through its recent history and as it is now. Comparisons to the rest of the US and the surrounding Great Lakes states are made, the latter being a group of states (Illinois, Wisconsin, Ohio, Indiana) that has a comparable history. A list of the counties in the State of Michigan, and their population characteristics is provided in Appendix 1: State of Michigan counties by class. A map of the counties and the location of the largest cities is shown in Appendix 2: State of Michigan counties and cities.

### 3.1 Michigan's economic condition

The state of Michigan can roughly be divided in three parts when it comes to economic activity. The Upper Peninsula is an area of mining and lumbering, the northern half of the Lower Peninsula is dominated by recreation and agriculture, and the southern part of the state is dominated by manufacturing, service-industry and agriculture (Mehretu and Summers, 1994). In 2008, the state of Michigan was home to 9.745.075 inhabitants. At that moment, the Combined Statistical Area Detroit-Warren-Flint accounted for 5.251.216 inhabitants, of whom 4.357.988 lived in the Detroit-Warren-Livonia Metropolitan Area. The principal city Detroit had a population of 764.338 at that point, making it the largest contributor of the Metropolitan area (Census Bureau, 2011). Livonia and Warren are often regarded as suburbs of Detroit. Because a relatively large share of Michigan's population either lives in Detroit, or in it's sphere of influence, extra attention is dedicated to Detroit at some points of this and the following chapters.

Starting with the population spread, fig. 3.1 shows how Michigan's urban areas are spread out over the borders of its counties. It also shows that the majority of its urban areas are located on the southern half of the Lower Peninsula. The Detroit metropolitan Area on the east side is the largest, and the other metropolitan areas are located on the east-west infrastructural axis in the south. Except for some small urban cores, the northern part of the state is of low population density.

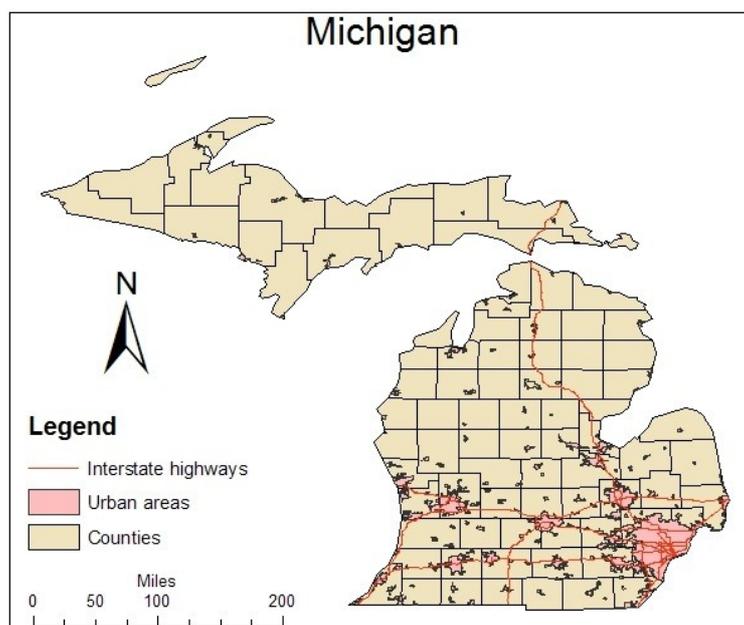


Fig. 3.1: Michigan's counties and urban areas. (Source: University of Illinois)

The large surface occupied by the Detroit metropolitan area is a result of the national tendency of urban areas to grow. “For all urban areas, population grew by 92,3 percent while land area increased by 245,2 percent between 1950 and 1990.” (Kahn, 2000, p. 569). Kahn (2000) also reports that suburban residents in Detroit live on lot sizes that are considerably larger than the national average. His research shows how in two income groups (up to \$50.000 and up to \$100.000 per year), Detroit suburbians live on 15.500 and 18.600 square feet, compared to 12.330 and 14.600 nationally. This results in Detroit's average vehicle mileage being the highest of all major 55 metropolitan areas in that research.

Through the 1960's and the decades after that, a new international division of labor took shape, in which developing countries took over large parts of production and manufacturing work from the western world (Schaeffer and Mack, 1997). This forced large parts of the western world to change their economy into a service economy, or knowledge economy. Michigan has not been successful in this shift, and this has led the state to economic stagnation or even deterioration. Compared to the rest of the US, Michigan's share of people working in the manufacturing-industry is twice as high (BLMI&SI, 2011).

Michigan's economy has a relatively stable relationship with the rest of the US. In case of recession and recovery, the state usually precedes the other states, and employment decline and growth are more radical. This pattern has been the same for thirty years now, with the exemption of the 2003-2007 period. During these years, the US as a whole showed recovery, but Michigan's number of jobs fell sharply. Fig. 3.2 shows this *one-state-recession* in comparison to the rest of the US and the surrounding Great Lakes states. It followed a period of relative prosperity, as in the late 1990's Michigan had more jobs per 1000 residents than the rest of the US (BLMI&SI, 2011).

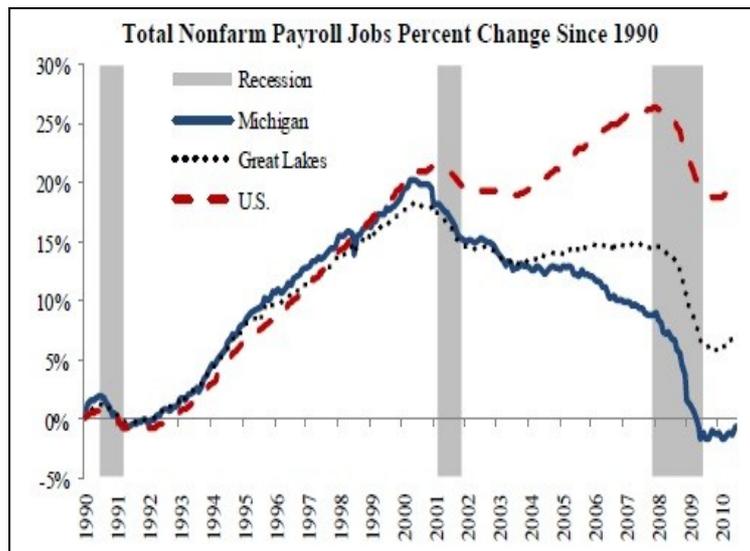


Fig. 3.2: Total Nonfarm Payroll Jobs Percent Change Since 1990. (Source: BLMI&SI, 2011)

Recently, Michigan's Department of Technology, Management and Budget described the economic condition as follows: “A decade ago, in 2001, the United States experienced an economic downturn. Then, while the rest of the nation recovered and prospered, Michigan spent several more years in a one-state recession of its own. That was followed by an even more severe national downturn. Although that recession officially ended in June of 2009, the nation's recovery has been slow and uncertain. Good times have not yet returned.” (MDTMB, 2011). The period from mid-2009 through end 2010 stabilized by the hand of the automotive industry, that recovered from bankruptcy. As production is not fully recommenced, employment is unlikely to fully recover on short term either. Where the first five months of 2010 brought an average job growth of 17.000 for Michigan, the amount of jobs was stable thereafter.

The recession has resulted in historically high unemployment rates for both Michigan and the rest of the US, with Michigan having the highest unemployment rate of all states. The manufacturing and construction industries lost the highest rates (28,4% and 23,5% respectively) of the more than 400.000 jobs Michigan lost in the recession. The losses in these sectors were caused by tightening credit, which prevented people from buying cars and houses. The unemployment dropped from 14.4 to 12.4 percent in Michigan over 2010, as the auto industry improved its financial health. The unemployment rate also dropped because of the out-migration of unemployed people. Still, as can be seen fig. 3.3, this particular recession has had a severe impact on Michigan. Compared to the 1990 and 2001 recessions, job-losses are lasting significantly longer. As the percentage of unemployed for over 27 weeks has climbed to over 50% of the total unemployed, the end of the recession is known as the jobless recovery.

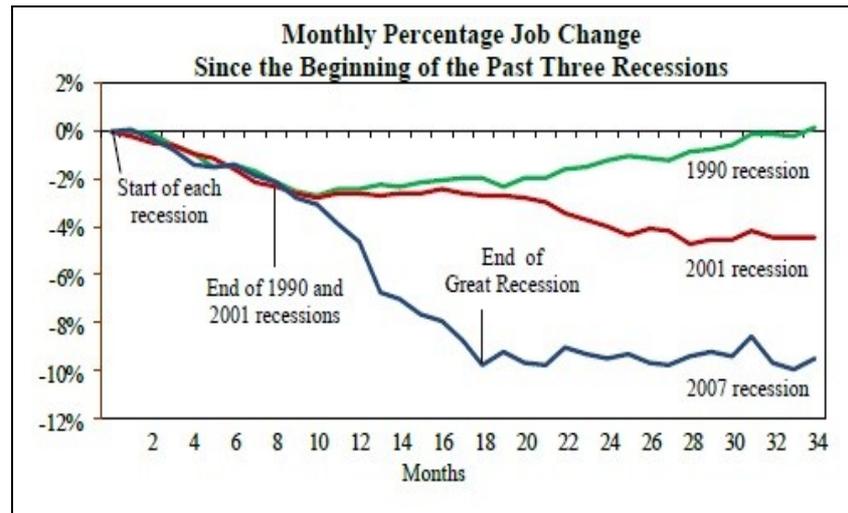


Fig. 3.3: Monthly Percentage Job Change Since the Beginning of the Past Three Recessions. (Source: BLM&SI, 2011)

Business start-ups perform slightly under the average of the US, the year 2000 cohort shows. 77,3% of the start-ups survived the first year and 47% still had employment in 2005, compared to 78,9% and 48,6% nationally. Less than one third still employed people in 2009, but a positive sign is that their employed staff grew from 9,4 to 19,2 on average.

Michigan's firms respond to the economic adversity by increasing their flexibility. This is done by employing more temporary workers, which can be hired on short notice when needed, and be disposed of just as easy when production shrinks again. Movements in the temporary work labor market usually precede the normal labor market. The role of temporary workers in Michigan has diversified in industries, occupations and skill level. There is a shift going on toward higher paid jobs, and there is also a strong connection to the manufacturing industry in Michigan, as can be seen in fig. 3.4 on the next page.

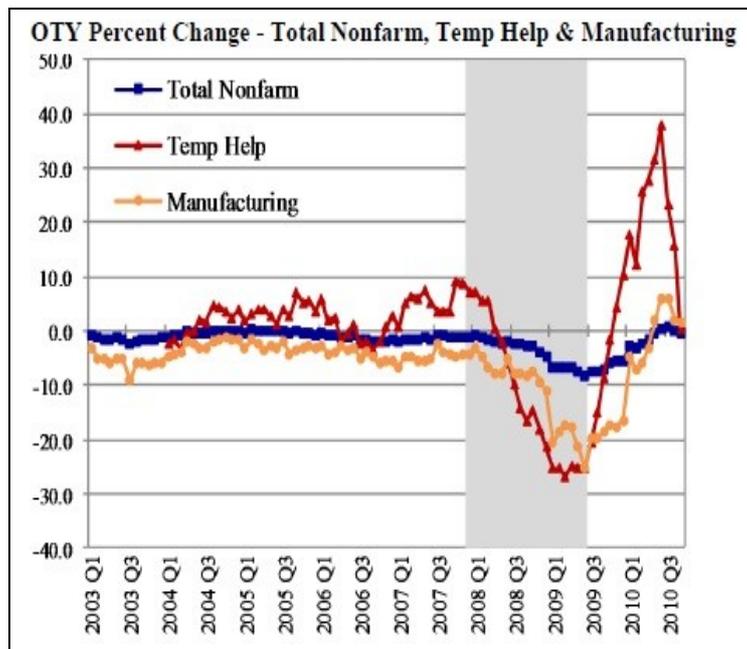


Fig. 3.4: Over The Year Percent Change of total employment, temporary help and manufacturing (Source: BLMI&SI, 2011)

Michigan's GDP per capita has been significantly lower than the rest of the US on average, and has dropped further in the last couple of years. Fig. 3.5 shows how Michigan has underperformed compared to the rest of the US, but also to the rest of the Great Lakes region. The GDP per capita gap is increasing as Michigan is falling further away from its peers. The GDP per industry shows how vulnerable Michigan's manufacturing-industry is compared to the rest of the US. During 2008-2009, Michigan's manufacturing-industry's GDP fell by about 17%, the rest of the country saw that sector turn in 6% of its GDP. A quick comparison to other states: Michigan's Gross State Product per capita was ranked as 42<sup>nd</sup> in 2010 (USGR, 2011), and the seasonally adjusted unemployment rate in December 2008 was the highest of all states, at 10,6% (BLS, 2011).

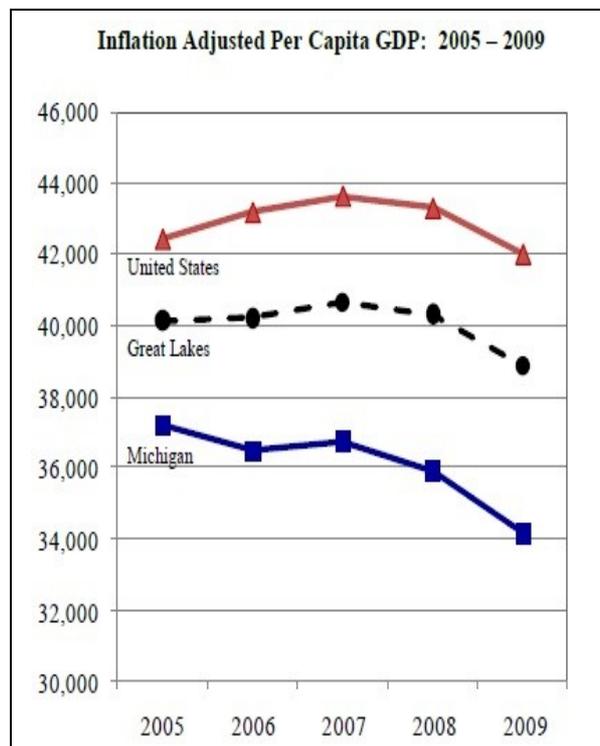


Fig. 3.5: Inflation Adjusted Per Capita GDP: 2005-2009. (Source: BLMI&SI, 2011)

### 3.2 The state of Michigan in quantities and qualities

The previous paragraph found Michigan's economy is not doing well compared to the rest of the US. Looking into Michigan's statistical profile might illustrate this picture, or give some explanation.

We start by looking at population development. With the exception of the WWII period, the population of Michigan has been growing rapidly over most part of the 20<sup>th</sup> century. Since the 1970s, a steady decline has set in, as can be seen in fig. 3.6. 1990-2000 period is marked by a significant revival, but the most recent decade is the first to show a decline of inhabitants.

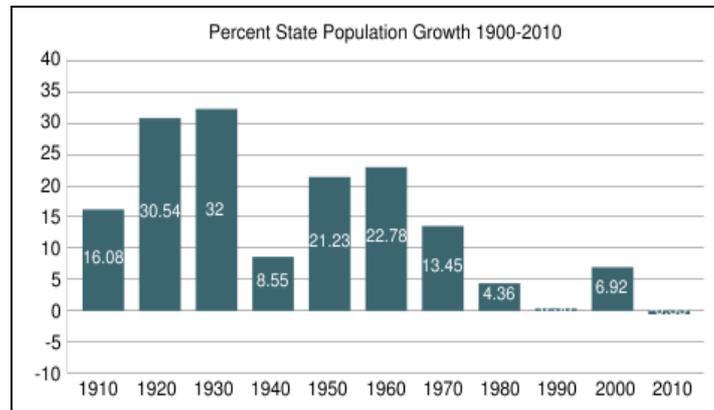


Fig. 3.6: Percent State Population Growth 1900 – 2010. (Source: Censusscope, 2011)

When discussing economic performance, education is one of the first things that come to mind in the modern knowledge economy. The numbers show Michigan is not doing very badly compared to the rest of the US. In fact, 83,4% of the persons over 25 years is a high school graduate, compared to 80,4% nationwide. In higher education the state is lagging, with 21,8% of the persons over 25 years old having a bachelor's degree or higher, compared to 24,4% in the rest of the nation, but this is not indicating a total brain drain (Fedstats, 2011). The overall level of education should at least be enough to keep the economy viable. The supply of educated workers doesn't seem to be a problem, in 2009 6% of those holding a bachelor's degree or higher was unemployed. It seems the structure of labor demand by education in Michigan differs from the rest of the US, as figure 3.7 shows.

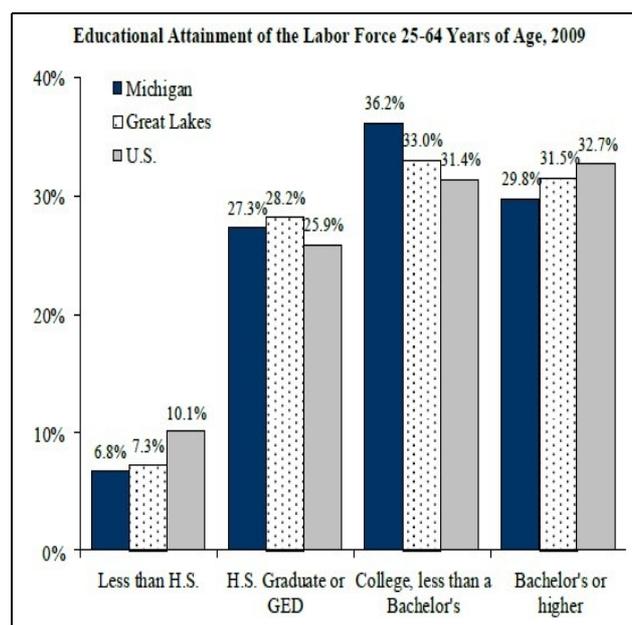


Fig. 3.7: Educational Attainment of the Labor Force 25-64 Years of Age, 2009. (Source: BLMI&SI, 2011)

Michigan has pockets of creativity and highly educated people, like East Lansing. However, it also contains some of the areas in the US with the lowest densities of creative workers, like Grand Rapids. As a region, Detroit does not do well in terms of the amount of people holding a Bachelor's degree or higher. On the sub-regional level however, Ann Arbor (part of the Detroit region) does very well (Florida, 2003). These differences indicate how polarized Michigan is under the surface, a trend that is subscribed by Florida at both the inter- and intra-regional level. Still, Michigan's past is of strong influence on its current condition. Michigan's metropolitan areas are regarded as organizational age communities, "These are older corporate dominated communities such as Cleveland, Detroit, Grand Rapids, and Kalamazoo. They have average social capital, higher -than-average political involvement, low levels of diversity, and low levels of innovation and high-tech industry." (Florida, 2003, p. 14).

This structure is reflected in the migration pattern of young, highly educated people entering and leaving the state. During 2008-2009, an estimated 29.700 of them left the state, and only 16.800 came in, which is the lowest inflow nationally. In case of the highly educated workers, the auto-industry plays an important role again. Three out of four scientists and engineers is employed as an engineer. The automotive industry leads Michigan to do well in terms of patents issued, it is first of the Great Lakes states, and also ahead of the US on average. This benefit does harbor a weakness, as innovation is almost completely reliant on a single industry. The current leading position is because of a large number of patents issued in the late 1990s, but is starting to fall back again over the last three years (BLMI&SI, 2011).

Incoming venture capital shows the automotive industry is unlikely to be the industry of the future. Despite the car-industry's dominant presence, it is biotechnology that has attracted most of this capital over the last years. Compared to the rest of the Great Lakes region, Michigan has done well in attracting capital. During 2008, venture capital formed 0,07% of Michigan's GDP, compared to 0,05% in the other Great Lakes states. Still, they are all way behind the average of 0,20% nationwide (BLMI&SI, 2011).

The population growth of the state is lagging behind the national average: Michigan's population grew only 0,7% from 2000 through 2008, where the US population as a whole grew 8,0%. It must be noted that much of this growth comes from immigration and the higher birth rate amongst immigrants, groups that are largely concentrated in the southern parts of the US – in 2007, 4,0% of Michigan's population was of Hispanic or Latino origin, for the US this was 15,1% (Fedstats, 2011), but this does not explain the huge difference. Clearly, people are leaving the state.

In the US the average percent of people living below poverty is 13%, the percentage is slightly higher in Michigan at 13,9%. The poor shape of the economy has not led to continued extra support from the federal government. In 2007, the federal spending per capita was \$7,114 in Michigan, but in the rest of the US the federal government spent an average of \$8,410 per person (Fedstats, 2011). It must be noted that some large car producers have been bailed out by the federal government, and though these investments are not included in these figures, they did save a lot of jobs.

As stated in the beginning of this chapter, the Detroit metropolitan area of the state is supposed to be of great influence on the economic well-being of the whole state. Table 3.1 on the following page compares Detroit city to Grand Rapids (Michigan's second largest city), the whole state and the rest of the US. It shows that by almost all measures, Detroit is performing dramatically compared to the rest of the state, which itself has been shown to perform poorly. Further economical comparison of Michigan to the rest of the US is provided in paragraph 3.3.

<i>Indicator</i>	<i>Detroit</i>	<i>Grand Rapids</i>	<i>Michigan</i>	<i>US</i>
Population, pct change, April 1, 2000 to July 1, 2006	-8,4%	-2,4%	1,6%	8,0%
Black persons, percent, 2000*	81,6%	20,4%	14,2%	12,8%
Bachelor's degree or higher, pct of persons age 25+,	11,0%	23,8%	21,8%	24,4%
Homeownership rate, 2000	54,9%	59,7%	73,8%	66,2%
Median value of owner-occupied housing units, 2000	\$63.600	\$91.400	\$115.600	\$119.600
Median household income, 1999*	\$29.526	\$37.224	\$44.667	\$50.740
Per capita income, 1999*	\$14.717	\$17.661	\$22.168	\$36.714
Persons below poverty, percent, 1999*	26,1%	15,70%	10,5%	13,0%
Black-owned firms, percent, 2002	55,8%	8,3%	6,0%	5,2%
Women-owned firms, percent, 2002	40,1%	23,7%	29,6%	28,2%
Retail sales per capita, 2002	\$3.543	\$9.908	\$10.892	\$10.615

Table 3.1: Detroit, Grand Rapids, Michigan and the US in numbers. \* US data is for 2007 (Source: Fedstats, 2011)

The huge black population in Detroit may be the most striking difference among these numbers, but the relative population change speaks for itself too. In Detroit, only half as many people over 25 years old have a bachelor's degree or higher as in the rest of the state, making Detroit lose its supposed metropolitan highly educated labor supply. The two cities in this comparison show some interesting differences and resemblances. They both have a shrinking population for example, but the Grand Rapids population's level of education is much higher. In terms of income and other economic indicators, Grand Rapids usually performs between Detroit and Michigan's average, only emphasizing Detroit's economic misery.

In terms of economic indicators such as home-ownership, the value of houses, median income and poverty rate, the situation in the city seems to be out of place compared to its surroundings. This leads to higher crime-rates and may also have a relation with the pattern of out-migration. The higher rate of black-owned firms may be a result of the higher proportion of blacks in the population, but the higher rate of women owned firms and unemployment might hint to another option. Starting your own business is a logical solution to unemployment, and has been linked to economic development (Porter, 1998), but research shows start-ups that are motivated through necessity are less successful in terms of survival (Bruins et al., 2000), so these businesses are unlikely to help Detroit escape the economical adversity. Retail sales per capita show that there is not much money in it for most shop-owners in Detroit (retail sales per capita 2002: \$3.543) when compared to the rest of Michigan and the US, \$10.892 and \$10.615 respectively.

A final note that is relevant to the context of this research concerns the daily commute people make. Detroit has been found the second worst city of the US in terms of hourly delay while traveling to work. All people that take public transport, walk or carpool added up together make only 11%, the lowest of any big city in the US, and leaving the other 89% to take the car (Forbes, 2008).

### 3.3 Mix and share analysis

To get a better understanding of Michigan's economy, it is compared to the United States as a whole. Using the mix and share, or shift-share analysis, the assumption is that a region's growth (measured in employment) is composed of three effects. The first is the *national growth effect*, or the average growth of the whole nation over the period of analysis. Second is the *industry mix*, the distribution of employment over the specific mix of faster and slower growing industries in the region, relative to the national average. Third is the *regional share* of the total national employment in each industry category (Bendavid, 1991). The mix and share analysis gives a good idea of how a region's industrial mix and total economy has performed compared to the nation.

Using data from the Bureau of Economic Analysis (REIS table CA25N), the mix and share analysis has been performed on the State of Michigan and compared to the United States as a whole, for the period 1970-2008, displayed in figure 3.8. The table shows the relative regional shift and industry mix, compared to the national development as the point of reference for each year.

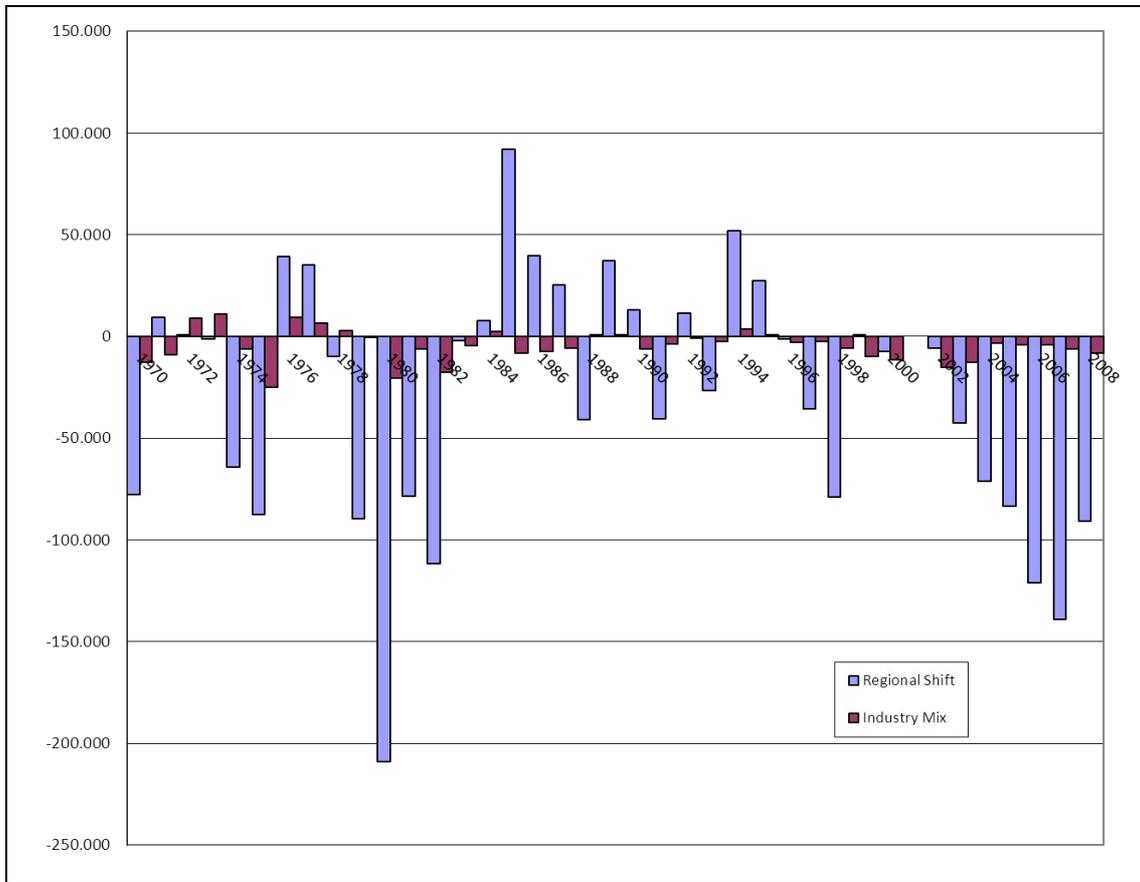


Fig. 3.8: Shift share analysis Michigan and US economy. (Source: BEA, 2011)

It's clear Michigan has performed poorly most of the years, albeit with some exceptions. In the early 1980's the US government decided to loosen their monetary policy, resulting in a lower value of the US dollar, as can be seen in fig. 3.9.

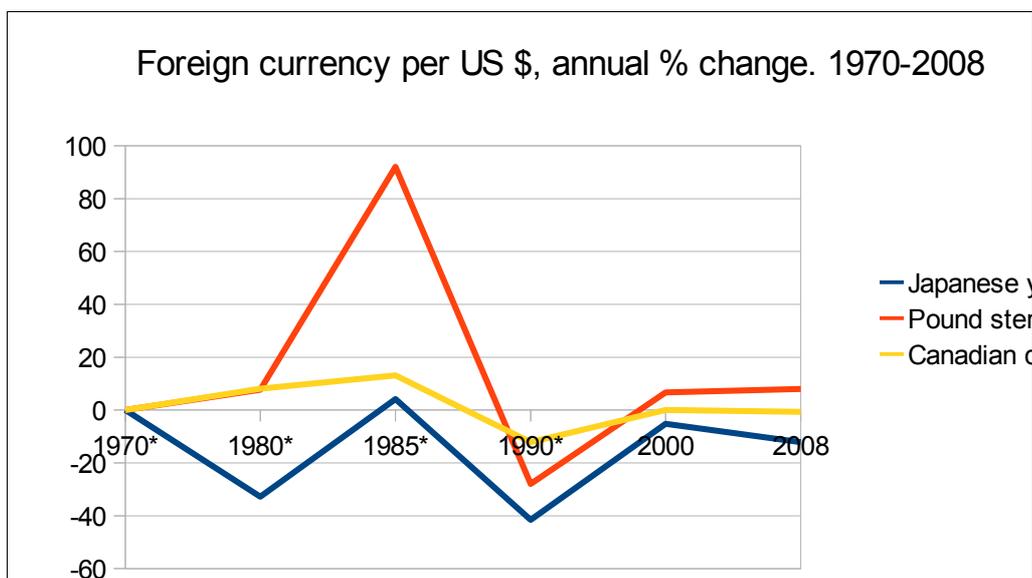


Fig. 3.9: Foreign currency % change to US \$ 1970-2008. \*Value at start of year (Source: RBA, 2011, FRSR, 2000, 2011)

Michigan's car-industry benefited from this development, as it became very cheap for the rest of the world to import American cars. This resulted in a period in which Michigan's economy performed relatively well. Prognoses based on the most recent years in this analysis are not good, as the state obviously under-performs.

What should become clear from this table is that Michigan's industry mix may not be the best, but it is not accountable for the economic crisis the state has experienced. The industry mix has been only a small drawback to the economic development, compared to the huge loss of jobs Michigan suffers in many of the years, to the rest of the nation.

### 3.4 Summary

Summarizing this chapter, the following points are most important to remember. First, the economic engine of the state is almost completely concentrated in the southern part of the Lower Peninsula, with the Detroit metropolitan area being the dominant region. The Detroit metropolitan area occupies a huge area, which is partly to blame on relatively large residential lot sizes. It is shown that population growth has been steady for most of the twentieth century, but has started to fall back and even went into decline towards the end of the century.

Much of Michigan's economy is still relying on the car and other manufacturing industry, while other states have advanced to an economy that is more based on service industries. Michigan's workforce has twice as much people employed in manufacturing than the US on average. Michigan is outperformed by the rest of the US on nearly all relevant economic indicators. Detroit performs very poorly compared to the rest of the state. People in the state respond to unemployment by starting up small businesses, firms respond by hiring flexible workers.

The level of education in Michigan does not fall far behind the rest of the US, although there are more people holding a college degree and less people holding a bachelor's degree or higher. An exceptional high rate of the scientists works as an engineer, all this is explained by the large manufacturing industry. The car industry is almost the only source of innovation, and it has started to run out in the last couple of years. With little money coming in as investment or as federal government support, a way out of the economic crisis is unlikely to come from the outside.

The mix and share analysis shows that Michigan economic malaise has been going since the 1970s, with the revaluation of the dollar as the only period that brought relief. The mix and share analysis also pointed out that Michigan's complete industry mix is not to blame entirely for the economic crisis.

## Chapter four: Hypotheses and methodology

The theory and context that were attended in the former two chapters have led to the formulation of the following hypotheses. The current chapter also informs about the form of data and the data-sources are provided. Consequently, the methodology to analyze if these hypotheses are true or false is explained.

### 4.1 Hypotheses

The relevance of sub-urbanization to this study is how it has left the old industrial cities. Though very successful for almost a century, they became unnecessary in the world-economy of the postwar period. Disinvestment in the old cities followed, fueling the parasitic growth of the suburbs. To make matters worse for Michigan, the whole industrial area turned into Rust Belt, and migration turned south to the Sunbelt (Beauregard, 2006).

Based on theories and observations such as presented by Fishman (1996) and Rothblatt (1994), it's likely that Michigan's urban system has changed. From a hierarchical system in which large central cities dominate smaller cities and their own surroundings, a transition is made to a poly-centric urban system, as is described by Garreau (1992). Those new, smaller centers house both population and commercial activity. Data analyzed in the previous chapter has introduced some socio-economical characteristics that are likely to influence spatial settlement patterns, as well as the economic performance of the state of Michigan through 1970-2008.

Paragraph 2.1, decentralizing population, briefly discussed Rothblatt's (1994) schedule of stages through which metropolitan areas are thought to pass in terms of centralization and decentralization. When comparing the Detroit metropolitan area to this schedule, it seems the area is now in either stage 4: relative decentralization, or stage 6: decentralization, depending on which scale the case is studied. On a lower scale, the Detroit metropolitan area would be in stage 4, with the city's core being drained and the ring and metropolitan area as a whole growing. It can also be said that on a higher scale, Michigan's entire south is seen as a metropolitan area, and it is now in stage 6. In that phase the central cities decline, and population and economic activity disperse away from the older metropolitan area to new outlying growth poles. Both scenarios imply a shrinking population in the old central cities. Outlying metropolitan areas and cities are expected to experience growth. The following hypothesis is meant to analyze the spatial distribution of population and employment over the period 1970-2008, to find how the decentralization has changed the distribution of people and jobs over the state.

*H1: Michigan's spatial economic structure in terms of population and employment distribution has changed from a mono-centric model in 1970, to a poly-nucleus model in 2008.*

Over time, many products have moved in their product life cycle as described by Vernon (1966). This has led to changes in the international division of labor (Mack and Schaeffer, 1997), meaning that the production-function of areas and cities over the world have changed. Central cities used to be production centers, but as many manufacturing became low-skilled work, high land rents forced factories out of central cities. Manufacturing industry is found to decentralize most of all industries because the plants occupy large surfaces, face-to-face contact is rarely required, etc. (Holmes and Stevens, 2004; Glaeser and Kahn, 2001). Therefore, the following is expected:

*H2: Counties on the fringe of Michigan's metropolitan areas have experienced a stronger growth of employment in manufacturing industry than other counties in the state of Michigan, over the period 1970-2008.*

In the American context, the mono-centric city model has repeatedly been proved outdated (Anas et al., 1998; Anderson and Bogart, 2001; Glaeser and Kahn, 2001). People living in suburban areas have become less dependent of the central cities (Jordan et al., 1998; Garreau, 1992). Research performed by Fuguitt (1991) indicates these developments should be reflected in commuting patterns. The contextual explorations have pointed out that the state of Michigan is a state that is marked by a profound commuting culture, leading to the last hypothesis:

*H3: The commuting patterns between counties have shifted from a core – periphery model in 1970 to a sub-center – sub-center model in 2008.*

## 4.2 Methodology

### *Data sources and contents*

To approve or reject the hypotheses, a substantial body of data is required. Secondary data is acquired from multiple U.S. government sources. This paragraph sums up what data will be used, where it comes from and what it contains. Complete and accurate data for the entire period is sometimes unavailable due to incomplete digitalization of data in the earlier years, and data from the most recent years may not have been published yet. This means some parts of the analysis start at a later point in time or stop earlier.

First of all, demographic data is needed for the State of Michigan, indicating how many people have been living in all counties, through 1970-2008. This data is gathered from the decennial U.S. Census and the American Community Survey (ACS), which is freely accessible. The US Bureau of Census has been a decennial source of data until the year 2005. At that moment, the ACS was implemented to provide data more frequently. It is important to realize that the ACS is not a count but a survey. This means that for smaller counties, the ACS has not provided estimates that are accurate enough to be used. For those counties, the lacking information is replenished with data from a year that is closest.

The US census and ACS hold track of the county in which a person lives and works. This creates a database that gives an indication of the population in a county (by Place of Residence), and the amount of employment (Place of Work). This data will be used to follow the developments of employment centers. Logically, people who don't work don't have a PoW, and they are not incorporated in this survey. This means the PoR can only be used as a proxy for the development of population. As the data provides the origin of the workers in a county, info about commuting flows can be generated. This dataset forms a cornerstone in the analysis. This data is available throughout 1970-2008, providing what's needed to understand the development and shifts of employment-centers.

As mentioned before, for some small counties data was not yet available for the latest years. They are listed in table 4.1 on the next page. For the Place of Work (PoW) and Place of Residence (PoR), this means data is added from the year 2000. For the population surveys, the required data is added from the more complete 2005-2009 ACS.

<b>FIPS</b>	<b>County</b>	<b>FIPS</b>	<b>County</b>
26001	Alcona	26085	Lake
26003	Alger	26095	Luce
26011	Arenac	26097	Mackinac
26013	Baraga	26113	Missaukee
26019	Benzie	26119	Montmorency
26039	Crawford	26131	Ontonagon
26053	Gogebic	26135	Oscoda
26071	Iron	26141	Presque Isle
26079	Kalkaska	26153	Schoolcraft
26083	Keweenaw		

Table 4.1: Incomplete data counties

To find out how the functional organization in terms of industries is spread out over the State of Michigan, county business pattern data is consulted. Using additional data from the State of Michigan's administration, a comprehensive image of Michigan's industries and its location can be derived. The Bureau of Economic Analysis (BEA, 2011) produces the Regional Economic Information System (REIS), which contains all information about employment by industry, per county. This data is available through 1969-2000 and thus lacks the last part of the analysis, but it is so comprehensive that it can still contribute a lot.

### *Methodology*

The following methodology is used to test the hypotheses. All gathered quantitative data is organized using database and statistical software, and the results are sometimes plotted using GIS to get a better interpretation of the findings.

In the field of urban and regional economic development, the importance of the city and metropolitan area for the region's economic growth is commonly recognized. In all sorts of research and data gathering and distribution, the metropolitan area is also a common unit of measurement. In the US, the metropolitan area is defined by the Office of Management and Budget. It defines Metropolitan Statistical Areas (MSA's) as an area containing a recognized population nucleus and adjacent communities that have a high degree of integration (25% of the population commutes either way) with that nucleus (Isserman, 2005). As the OMB is one of the large data-providers of the US, their definition is commonly used in all sorts of research and policies, so that is how it is used in this research as well.

As this study aims to reveal the structure of Michigan's economy at a regional level, there must be some idea of what is meant by region. From an economic point of view, is the state of Michigan a region by itself, or is part of a region – the Rust Belt for example, or is the state dividable into different regions internally? The main problem when talking about regions is that they usually don't follow jurisdictional borders. That means a lack of information, as data is usually gathered on county or state-level, while the region may go over these borders without being noticed in any research (Barnes and Lebedur, 1998). At the same time, any location's economic climate is under influence of the tax-regime and policies of the jurisdictional boundaries in which it falls, so the formal borders do play a significant role. As chapter three pointed out that the southern part of the Lower Peninsula contained both the large agglomerations and most manufacturing industry, this area will logically be under most attention and no further selection based is made. Only counties in the state of Michigan will be subject of this research, to avoid different results that are caused by different policies.

The unit of measurement handled in this thesis is the county. The county is the lowest building block for which the necessary data is available, and it is a sensible sized area to study the state of Michigan. As any selection of counties is arbitrary and data is available for all, the analysis will be performed on all counties when desired, but sometimes the methods used require a selection. The developments in the more populated areas will be under most attention, as these counties contain the employment centers that are the focus of this research.

In order to test the hypotheses, the counties will be classified on the basis of several characteristics. The rural-urban continuum code, according to their characteristics in 1974 and also in 2003 is the first. The classifications in 1974 and 2003 are the ones that come closest to the starting and ending point of the period of analysis, 1970 and 2003. It indicates if a county is part of a metropolitan area and for the non-metropolitan counties, and it gives an insight in the size of its population. This code is published by the Economic Research Service (ERS, 2011). Another code that could be suitable has been developed by Isserman (2005), and emphasizes on a correct distinction of rural and urban population. However, in this research the counties role in the urban system as a net importer or exporter of employees is more important than whether it's urbanized or not. Another reason is that Isserman's classification handles a minimal population density of 500 inhabitants per square mile to be urban or even mixed urban. When looking at Michigan in 1970, that means only 4 counties to be qualified as such, all part of the same metropolitan area. As the research attempts to study a wider area this is too few, hence the choice for the urban rural continuum code. A description of this classification, followed by the number of counties with those characteristics in 1974, 1993 and 2003 is shown in table 4.2.

<i>Metropolitan counties:</i>	1974	1993	2003
Central counties of metro areas of 1 million population or more.*	1	5	2
Fringe counties of metro areas of 1 million population or more.	5	4	4
Counties in metro areas of 250,000 to 1 million population.	11	14	12
Counties in metro areas of fewer than 250,000 population.	8	2	8
<i>Non-metro counties:</i>			
Urban population of 20,000 or more, adjacent to a metro area.	3	2	5
Urban population of 20,000 or more, not adjacent to a metro area.	4	1	7
Urban population of 2,500 to 19,999, adjacent to a metro area.	10	11	8
Urban population of 2,500 to 19,999, not adjacent to a metro area.	22	25	22
Completely rural or less than 2,500 urban population, adjacent to a metro area.	3	3	3
Completely rural or less than 2,500 urban population, not adjacent to a metro area.	16	16	12

Table 4.2: County classification of Michigan: number of counties per class in 1974, 1993 and 2003. Source: ERS, 2011. \* In 2003, the classification has been revised, merging the metropolitan central and fringe counties into one class. As in this research further distinction is desirable, the decision has been made to go with the 1974 classification.

Grouping the counties into different classes makes it possible to select counties that meet certain criteria, and then compare their development to another kind of counties.

As the research not only tries to identify changes in the spatial economic structure, but also prove they are there, a statistical analysis is performed on the gathered data at some points. The statistical techniques require the amount of classes to be reduced to only two classes. This forced the decision to reclassify the counties into three classes. The classification on the rural-urban continuum code in 1974 is the leading indicator here, as that enables us to see how counties have developed from the way they were at that point in time. A second criterion was the population count in 1970, to further refine the new classification. This has resulted in three new groups of counties that will be called county types, in order not to confuse them with the previously distinguished classes:

1. Counties that were located in a metropolitan area in 1974 and held more than 100.000 inhabitants. (16 counties)

2. Counties that were in a metropolitan area in 1974 but held less than 100.000 inhabitants, or that were adjacent to a metropolitan area. (25 counties)
3. Places that were neither in a metropolitan area, or adjacent to one according to the 1974 classification. (42 counties)

The first type is regarded as the old urbanized core, and is compared with the second class to find results, where the third type will only be incorporated in some parts of the analysis, as they do not hold enough jobs to be relevant as an employment center.

*H1: Michigan's spatial economic structure in terms of population and employment distribution has changed from a mono-centric model in 1970, to a poly-nucleus model in 2008.*

Hypothesis one attempts to map the shift of population concentrations from 1970-2008. Based on ERS and census data, some maps are produced using GIS to provide a first insight in the situation. The most interesting developments are briefly discussed. Then, based on Census Bureau data, the PoW/PoR ratio can be calculated for each county. If the county has more workers than residents, it is an employment-center, and vice-verse. Together with population growth and employment growth, these factors are analyzed for all classes of counties, to identify which types of Counties are developing to be employment centers. Based on the numbers found here, statistical tests are run to see if the differences in growth rate are statistically significant.

*H2: Counties on the fringe of Michigan's metropolitan areas have experienced a stronger growth of employment in manufacturing industry than other counties in the state of Michigan, over the period 1970-2008.*

Information from the REIS database, provided by the BEA, tells how many people are employed in the manufacturing industry in all Counties, from 1970-2000. That makes this hypothesis relatively straightforward to test, although the last years are not covered by the data. Statistical tests point out if growth rates of manufacturing employment differ significantly between the metropolitan core, metropolitan fringe and rural counties.

*H3: The commuting patterns between counties have shifted from a core – periphery model in 1970 to a sub-center – sub-center model in 2008.*

To test this hypothesis, the metropolitan core class-counties are regarded as the core region of the state, and the metropolitan fringe class-counties are regarded as the location of the new sub-centers. Combined data from the US census and the ACS is gathered in a database that is copied into a spreadsheet as a pivot table. The spreadsheet is transformed into a cross-table of counties sending and receiving commuters. By selecting the counties from either the core, or sub-centers as sending or receiving, we can see how large the flow between both is.

## Chapter five: Results

This chapter concerns the analytical part of the research, by testing the hypotheses. Each of the hypotheses will be answered in a separate paragraph, after which the results are discussed.

### 5.1 Changing population and employment distribution

*H1: Michigan's spatial economic structure in terms of population and employment distribution has changed from a mono-centric model in 1970, to a poly-nucleus model in 2008.*

In chapter three, concerning the context and research area, the circumstances under which Michigan's population and businesses act have been discussed. This paragraph starts out with an analysis of the population and employment distribution in 1970 and 2008, and the most important changes that occurred in that period.

The maps depicting the spread on the rural-urban continuum code, as discussed earlier, in 1974 and 2003 are shown in fig. 5.2 and fig. 5.3, which are shown together on the next page. The related table can be found in appendix 1: State of Michigan counties by class, which is also the basis of the summarized table 4.2 in the previous chapter. We can establish that Michigan's counties have had a dynamic flow of residents from one to another throughout the last decades. Appendix 2: State of Michigan counties and cities gives the names and location of all counties and the most important cities on a map.

Fig. 5.1 presents the development of Michigan's population throughout 1970 – 2008, on the basis of the ACS survey. There are some changes in the distribution of population going on that deserve some attention.

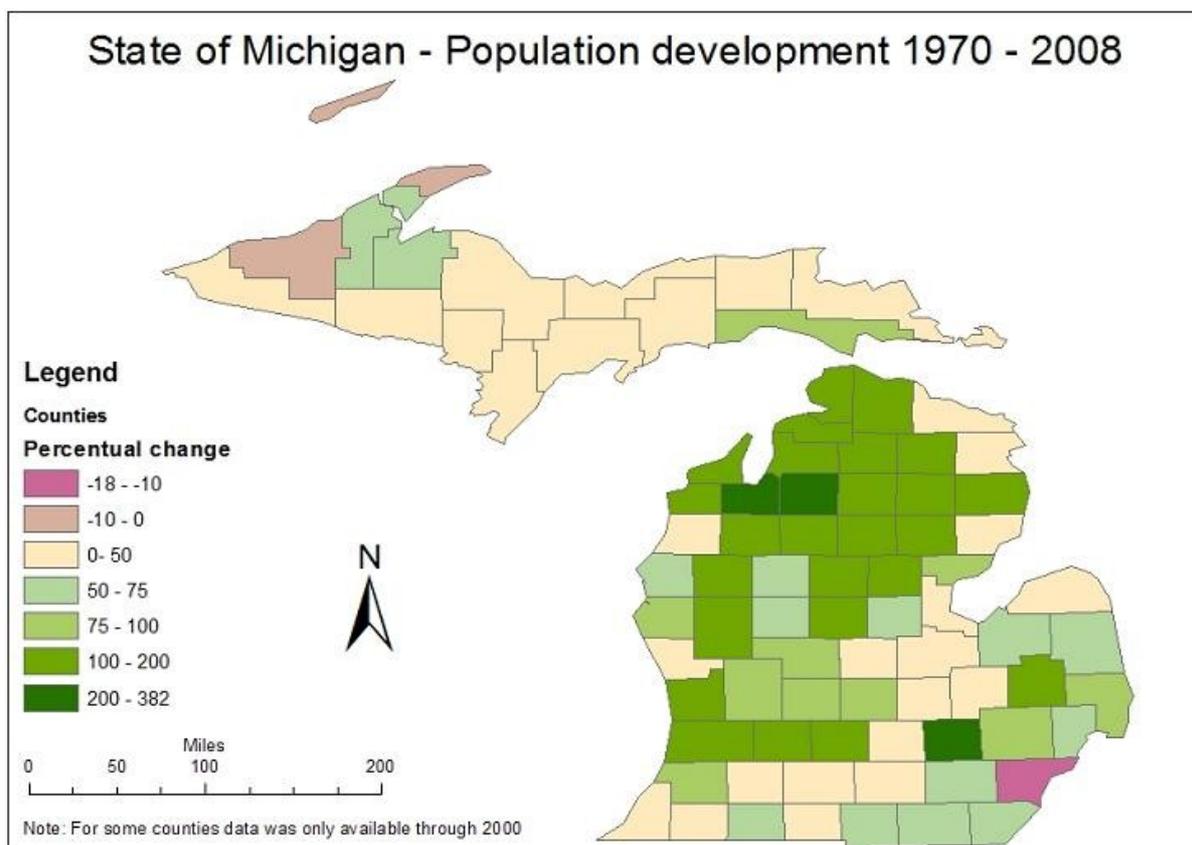


Fig. 5.1: State of Michigan – Population development 1970 – 2008. (Source: ACS data)

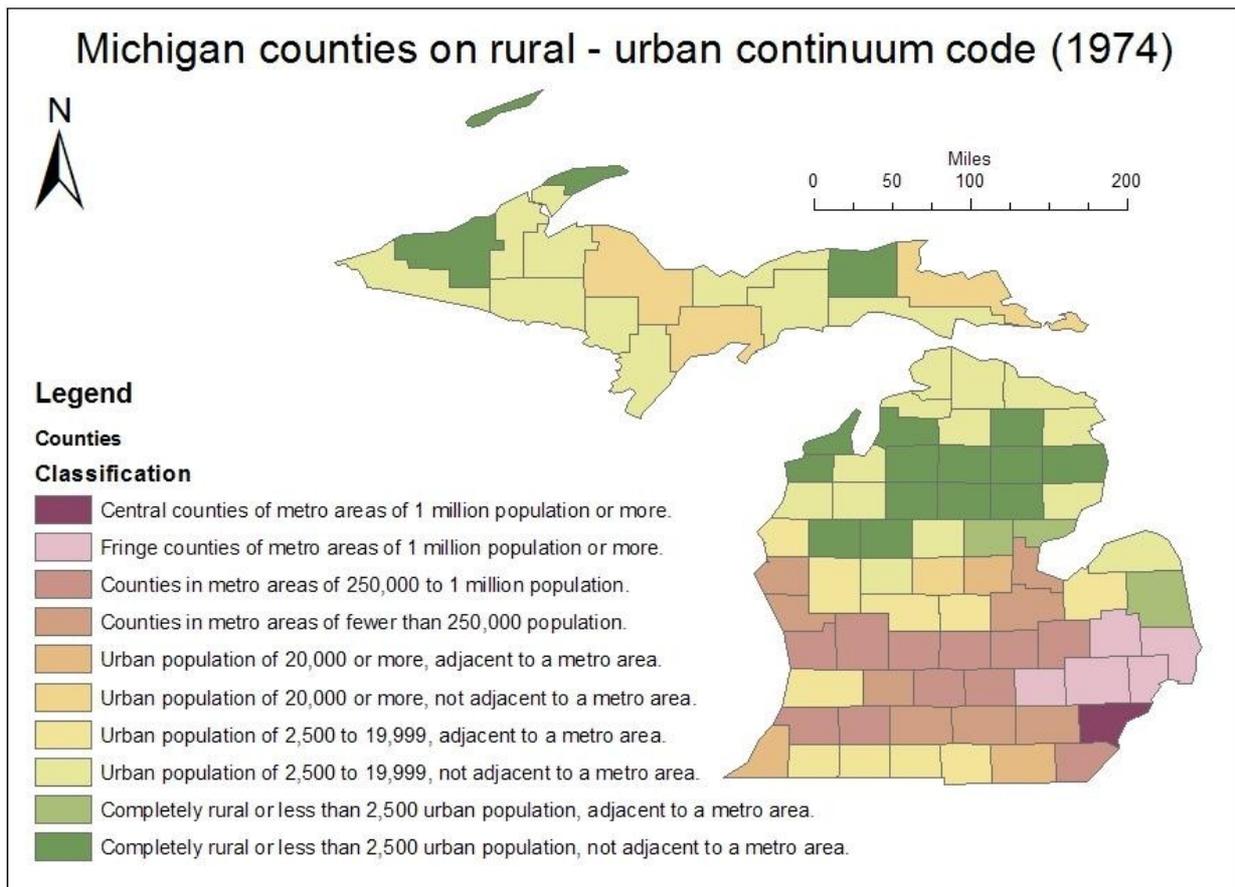


Fig. 5. 2: Michigan counties on urban – rural continuum code (1974). (Source: ERS, 2011)

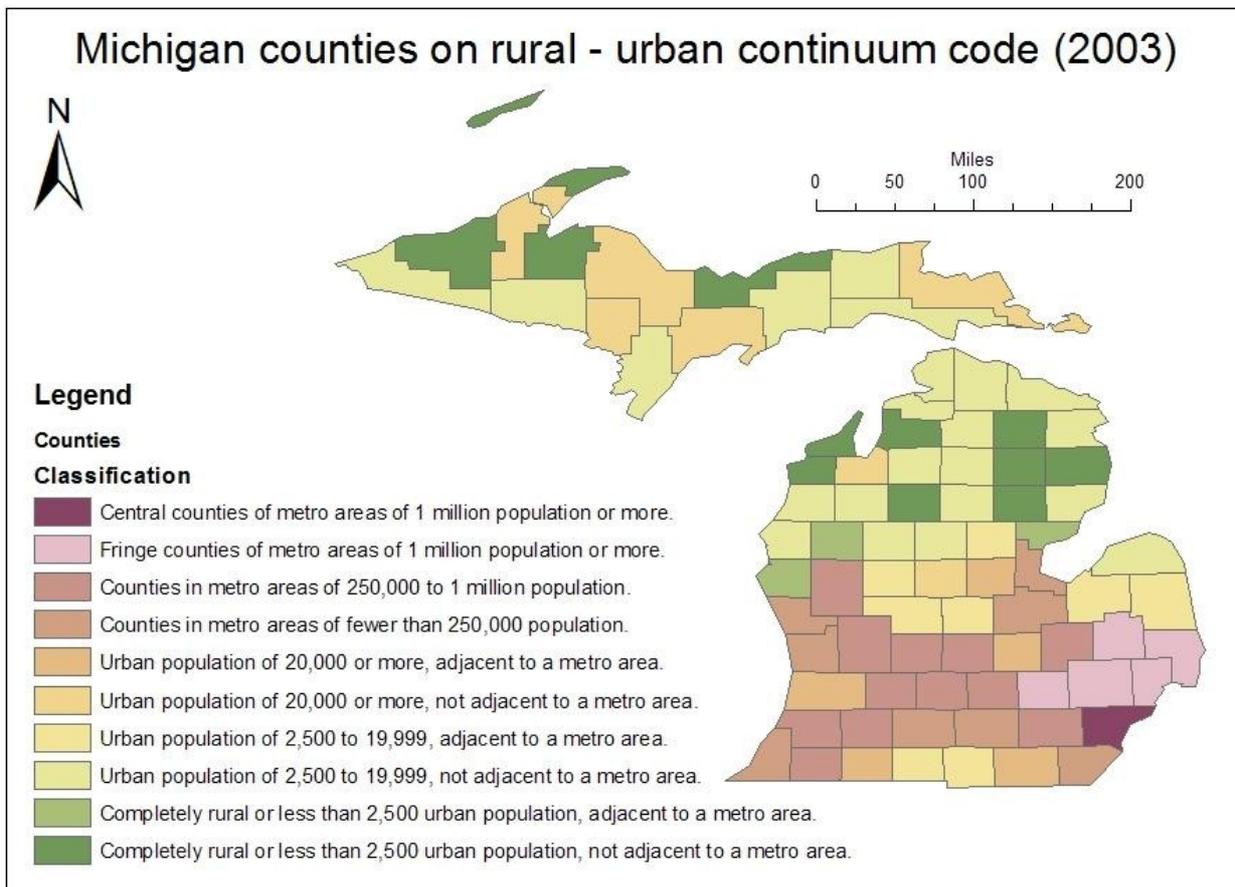


Fig. 5. 3: Michigan counties on urban – rural continuum code (2003). (Source: ERS, 2011)

First, the exodus from Wayne County, the largest county in the Detroit metropolitan area is highly exceptional. It is the only metropolitan county showing population decline, and a staggering 18%. And that while the surrounding counties were experiencing considerable growth, nearby Oakland even saw its population grow over 200%. A second thing to notice is the growth of the urban area in the southwestern part of the state. Thirdly, the low-density northern part of the Lower Peninsula saw its population grow quite strongly over a large area. This while the larger part of the Upper Peninsula only experienced moderate growth. A final interesting development is going on the most peripheral area, where two counties seem to be experiencing growth at the cost of their two neighbors, and the county closest to the Lower Peninsula also grows faster than its neighbors. Summarizing, Wayne County is losing population rapidly while the rest of both the metropolitan and non-metropolitan peninsula is experiencing growth, and the Upper Peninsula seems to experience stable growth with some light centralization at both geographical ends.

Looking at the distribution of employment, we first look at the situation as it was in 1970, in fig. 5.4. The map shows the Place of Work count per county, based on US census data. The dominant role of Wayne County at that moment is obvious, providing over 900.000 jobs where no other county reaches even one-third of that amount. Just like the population, most jobs are centralized at the southeastern part of the state, with a second concentration in the southwestern area. In the northern part of the Lower Peninsula, most counties only have a small amount of jobs, with the exception of some counties near the coast that hold up to 20.000 jobs. The Upper Peninsula has some of these concentrations in or near the areas where population was concentrating as well, and in the geographical center.

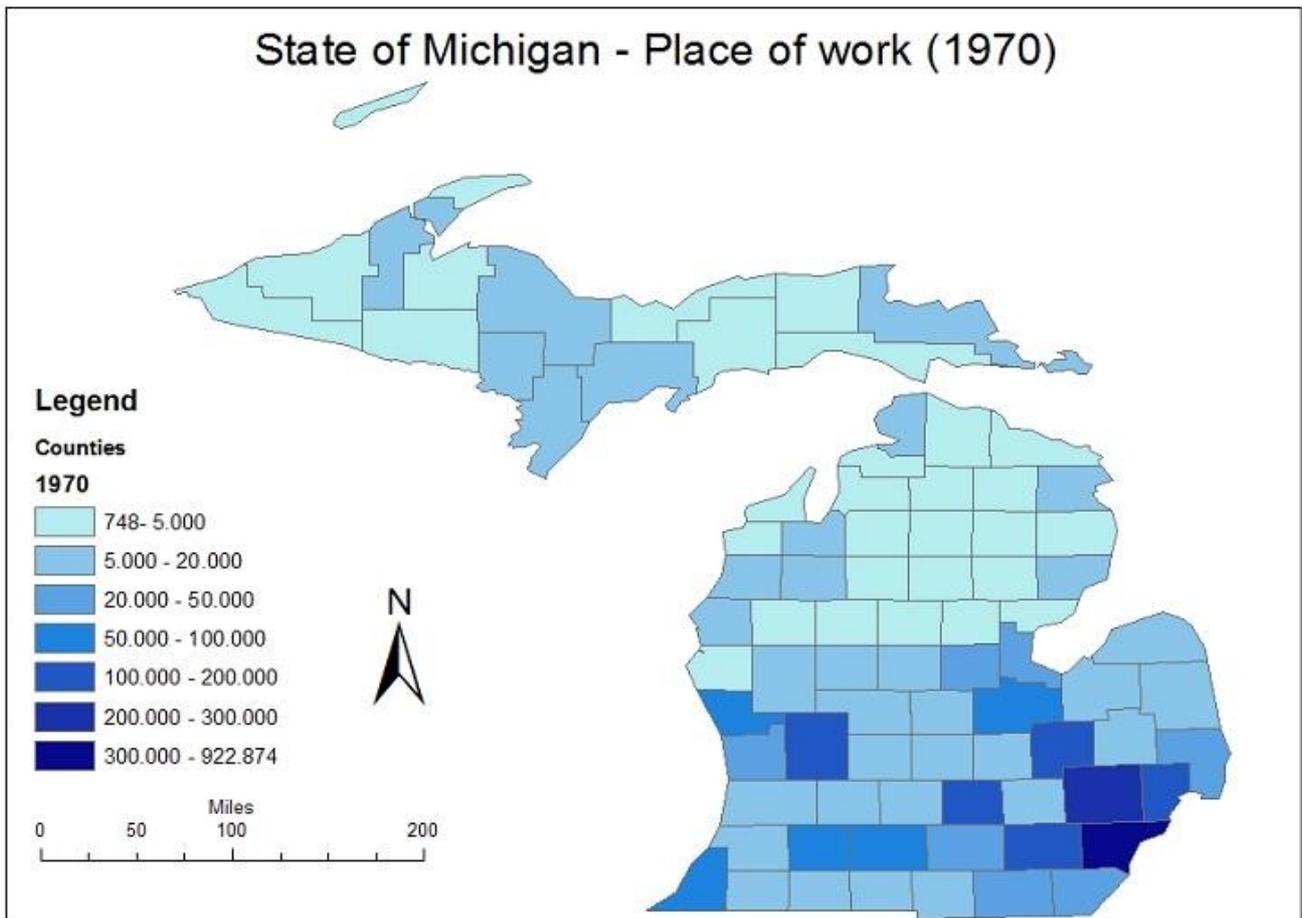


Fig. 5.4: State of Michigan – Place of Work (1970). (Source: US census data)

What is more interesting is how the distribution of employment has developed itself over time. Fig. 5.5 shows that over the period 1970-2008.

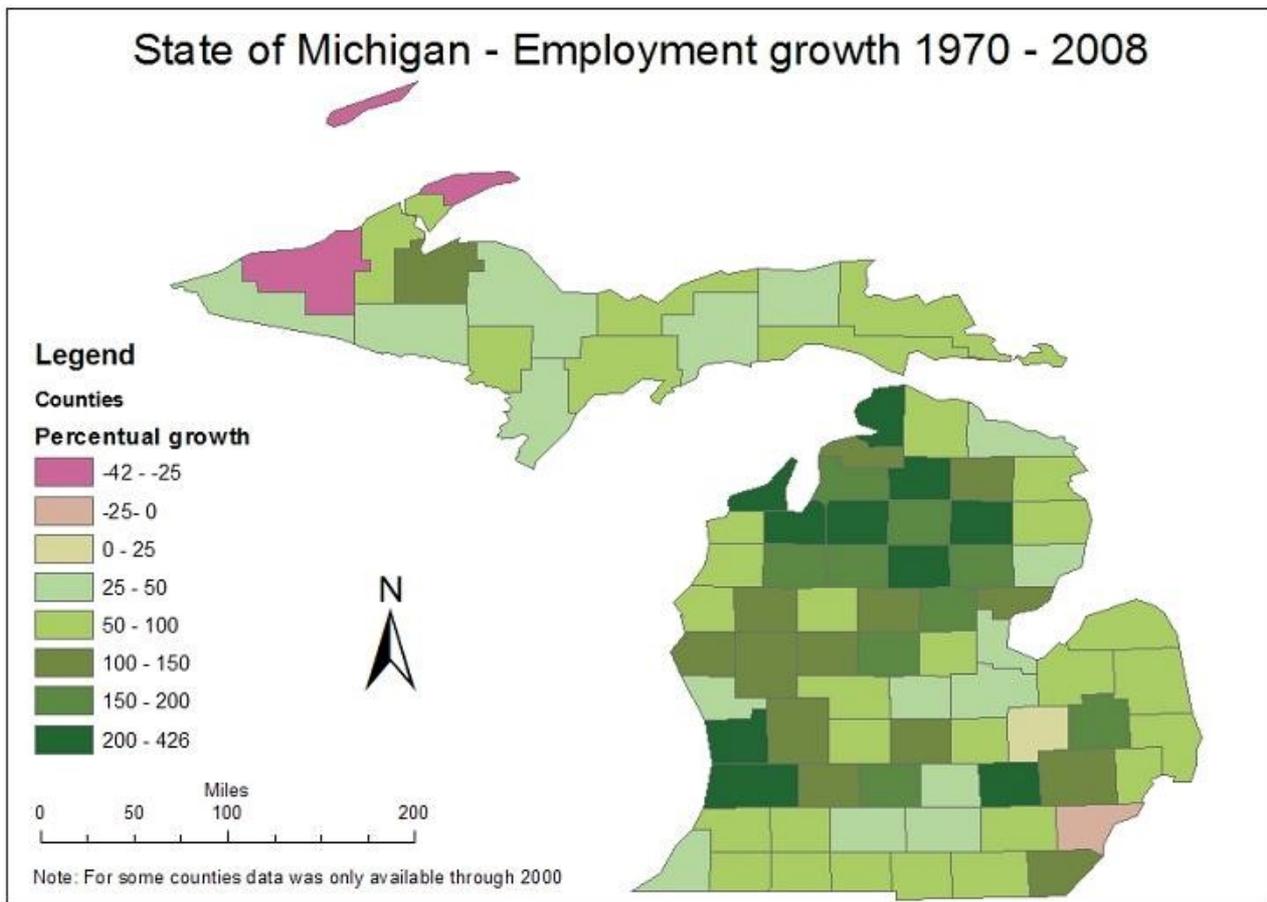


Fig. 5.5: State of Michigan – Employment growth 1970 - 2008. (Source: US census data)

This map shows some strong connections with the population development, and thus provides some answers but questions too. Once more, Wayne County is showing a loss while it's neighbors, particularly those on the north side, experience strong growth. The metro areas in the southwestern side of the state show strong growth again, as does the non-metropolitan northern part of the Lower Peninsula. The centralization of population on the western end of the Upper Peninsula is easily explained when the job growth in that area is considered.

Table 5.1 on the next page shows how the population growth is distributed over the different types of counties in the state of Michigan, 1970-2008. It shows all of Michigan's counties, aggregated to groups of similar location and/or population size. The unique development of Wayne County (the only class 0 county in the state) is obvious, but other patterns are worth noting too. The dominant pattern is that the largest and most central, and also the smallest and most peripheral counties are growing faster than those that are of intermediate size and location. Larger areas in metropolitan areas are growing faster than smaller ones, a form of centralization. It is peculiar that adjacency to metro areas is of no obvious influence to the population growth of smaller counties. All couples show similar growth levels. Smaller counties, tend to experience a higher level of population growth. The completely rural counties with less than 2,500 urban population that are not adjacent to any metro area are growing surprisingly fast, with an average growth of 81% over forty years.

The average growth of all metro areas averaged 9% from 1970-2008, where the complete non-metro area averaged 32%. This is reflected in a slightly diminishing share of the population living in metropolitan areas, from 83 to 80 percent.

**Average population growth in the state of Michigan: 1970-2008. Divided by Metro and non-Metro areas.**

<i>Metropolitan counties:</i>	<i>Average growth (%)</i>	2008*	2000	1990	1980	1970
Class 0: Central counties of metro areas of 1 million population or more.	-26	1.980.262	2.061.162	2.111.687	2.337.891	2.666.751
Class 1: Fringe counties of metro areas of 1 million population or more.	40	2.476.154	2.391.395	2.137.012	2.015.522	1.764.639
Class 2: Counties in metro areas of 250,000 to 1 million population.	28	2.360.267	2.290.534	2.105.397	2.008.685	1.847.114
Class 3: Counties in metro areas of fewer than 250,000 population.	14	1.216.626	1.193.326	1.123.838	1.131.112	1.069.998
<i>Non-metro counties:</i>						
Class 4: Urban population of 20,000 or more, adjacent to a metro area.	11	343.229	344.217	328.505	334.802	309.253
Class 5: Urban population of 20,000 or more, not adjacent to a metro area.	17	208.345	205.048	197.895	196.187	177.616
Class 6: Urban population of 2,500 to 19,999, adjacent to a metro area.	36	557.618	549.470	495.110	475.642	410.469
Class 7: Urban population of 2,500 to 19,999, not adjacent to a metro area.	32	579.531	579.665	523.855	512.931	439.796
Class 8: Completely rural or less than 2,500 urban population, adjacent to a metro area.	44	85.634	87.839	76.755	75.452	59.509
Class 9: Completely rural or less than 2,500 urban population, not adjacent to a metro area.	81	235.733	235.788	195.243	173.854	129.938
<i>Metropolitan counties</i>	9	8.033.309	7.936.417	7.477.934	7.493.210	7.348.502
<i>Non-metro counties</i>	32	2.010.090	2.002.027	1.817.363	1.768.868	1.526.581
<i>All counties</i>	13	10.043.399	9.938.444	9.295.297	9.262.078	8.875.083
<i>Population living in Metropolitan areas (%)</i>		80	80	80	81	83

Table 5.1: Average population growth in the state of Michigan: 1970-2008. Divided by Metro and non-Metro areas. \* Counties for which ACS data is missing have been filled in with census 2010 data.

(Source: Census Bureau data)

**Average PoW/PoR ratio in the state of Michigan: 1970-2008. Divided by Metro and non-metro areas.**

<i>Metropolitan counties:</i>	<i>Job increase (%)</i>	<i>Ratio change (%)</i>	06-'08	2000	1970
Class 0: Central counties of metro areas of 1 million population or more.	-13	6	1,05	1,03	0,98
Class 1: Fringe counties of metro areas of 1 million population or more.	121	18	0,99	1,01	0,84
Class 2: Counties in metro areas of 250,000 to 1 million population.	70	8	1,04	1,03	0,97
Class 3: Counties in metro areas of fewer than 250,000 population.	49	5	0,93	0,94	0,88
<i>Non-metro counties:</i>					
Class 4: Urban population of 20,000 or more, adjacent to a metro area.	77	6	0,84	0,86	0,79
Class 5: Urban population of 20,000 or more, not adjacent to a metro area.	107	16	1,04	1,08	0,90
Class 6: Urban population of 2,500 to 19,999, adjacent to a metro area.	64	2	0,80	0,82	0,78
Class 7: Urban population of 2,500 to 19,999, not adjacent to a metro area.	83	8	0,94	0,97	0,87
Class 8: Completely rural or less than 2,500 urban population, adjacent to a metro area.	125	13	0,73	0,70	0,64
Class 9: Completely rural or less than 2,500 urban population, not adjacent to a metro area.	95	-8	0,78	0,80	0,85
<i>Metropolitan counties</i>	47	8	1,01	1,01	0,93
<i>Non-metro counties</i>	84	7	0,89	0,91	0,83
<i>All counties</i>	52	8	0,99	0,99	0,92

Table 5.2: Average PoW/PoR ratio in the state of Michigan: 1970-2008. Divided by Metro and non-Metro areas. \* Counties for which ACS data is missing have been filled in with census 2010 data.

(Source: Census Bureau data)

The growth of population holds a somewhat irregular relation with the employment growth in the counties of Michigan, as can be seen in table 5.2. In Wayne County, the exodus of population was much larger than the loss of jobs, resulting in a relative growth of the jobs to population ratio. The job growth in other metropolitan counties followed that of the population growth. The larger the populations in each group of counties, the stronger the growth of employment. The ratio of PoW to PoR in those metropolitan counties in 1970 is rather low, at only 0,93. The status of employment center is only reached at the turn of the millennium in the fringe counties of the large (over 1 million in population) metropolitan areas.

Looking at the smaller counties, the employment growth is strong regardless of the size or location of the counties. Places with an urban population larger than 20.000 have a stronger growth of employment than those with 2.500-19.999 urban population, but the even smaller counties show a strong increasing amount of jobs. What may be even more surprising is that the non-metro counties that are not adjacent to a metro county show a stronger growth than their more centrally located counterparts. The completely rural counties also show a strong employment-growth, but in their case the counties that are adjacent to metro areas do show a stronger growth. When looking at the changing ratio of jobs to people in the non-metro counties, the employment growth is somewhat blurred by the population growth. This is especially the case for the peripheral, completely rural areas that are marked with a diminishing ratio of jobs to people.

Figure 5.6 demonstrates the PoW count in the 16 counties of the metropolitan core and the 25 metropolitan fringe type-counties, as explained in chapter 4. The graph shows how the distribution of employment has become more equal because of considerable growth in counties of different sizes. This effect is amplified by the largest being the only one to lose employment.

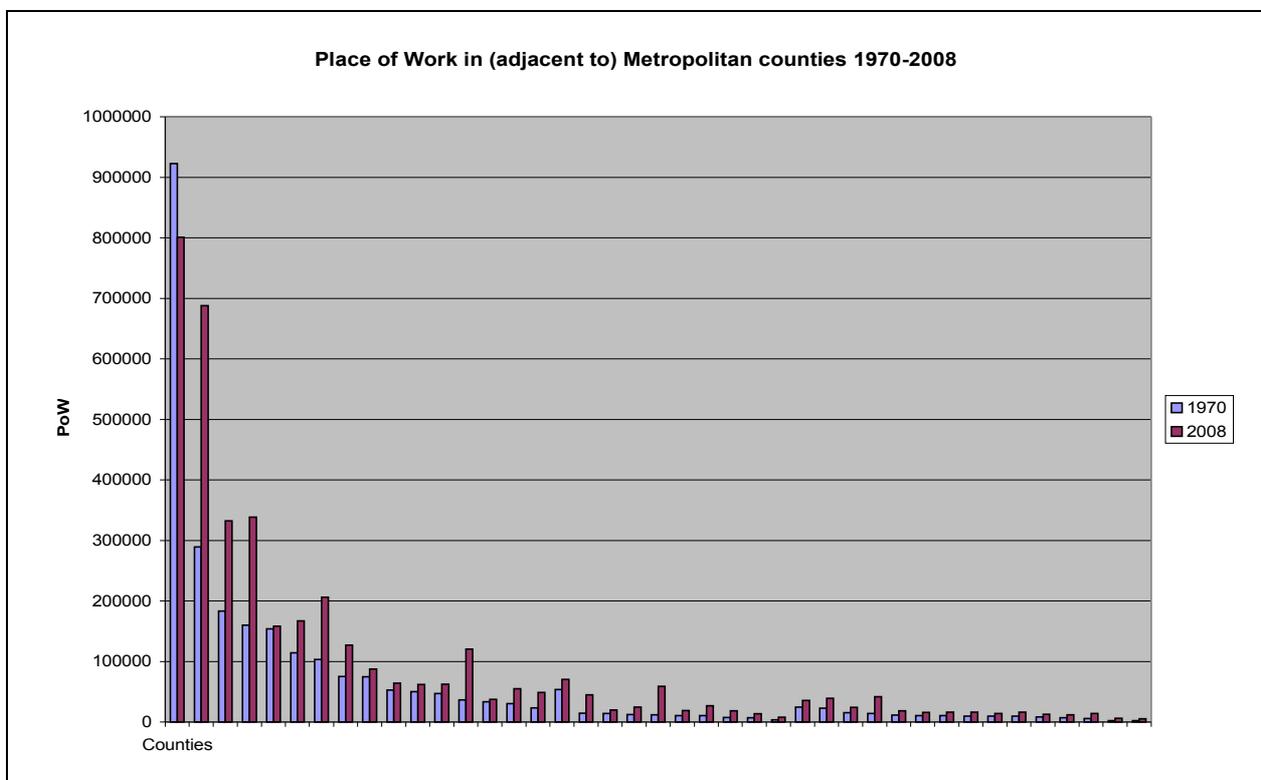


Fig. 5.6: PoW count in 26 metropolitan counties of 1970. (Source: Census Bureau data)

The percent growth of PoW in all counties has been analyzed using an independent samples T-test (Norušis, 2002). The mean growth in the 16 metropolitan counties of more than 100.000 inhabitants is 66,5%, where the 25 counties that were in a metro area but with less than 100.000 inhabitants or that were adjacent to a metro area averaged 105,7% growth. On a 95% confidence level, the hypothesis that both groups have an equal growth rate has to be accepted (significance 2-tailed 0,099; equal variances not assumed). However, at this significance it is only just, what may be caused by the relatively small number of cases. The numbers indicate there is certainly a tendency for the metropolitan fringe counties to boost a stronger growth.

Besides the absolute growth of employment, the relative growth of employment to the population is an indicator of the importance of a county as an employment center. Using the census bureau data, we can find the number of people that identify a county as their PoW and PoR. Dividing the first by the latter creates a ratio that indicates the number of jobs to people. If this ratio is higher than 1, this means a county employs more people than it houses, making it a net employment center. The hypothesis that metropolitan fringe counties are becoming increasingly important as employment centers means they are expected to show a rising ratio of jobs to people.

The PoW/PoR-ratio of the metropolitan core and fringe has been compared to each other using a T-test for independent samples. Contradicting the hypothesis, the metropolitan core experienced a stronger mean growth (0,075) of PoW/PoR than the metropolitan fringe (0,0508) through 1970-2008. These tested to differ insignificantly from each other on a 95% confidence scale (Significance 2-tailed 0,447, equal variances not assumed), but the hypothesis is clearly proved wrong on the basis of the ratio.

## 5.2 Industrial dispersion

*H2: Counties on the fringe of Michigan's metropolitan areas have experienced a stronger growth of employment in manufacturing industry than other counties in the state of Michigan, over the period 1970-2008.*

The manufacturing-industry dispersion is measured from 1970-2000. The average growth of manufacturing employment over this period averaged 7,2% in the 16 metropolitan core counties, and 62,8% in the metropolitan fringe counties. Using a T-test for independent samples once more tells us we cannot accept the hypothesis that the average growth is equal (significance 2-tailed 0,034; equal variances assumed). The 42 rural counties have been compared with the metropolitan core and the metropolitan fringe counties too. The average growth of industrial employment from 1970-2000 has been high in the rural counties, at 123,2%. When compared to the metropolitan core, this growth rate cannot be accepted to be similar (significance 2-tailed 0,012; equal variances not assumed), as expected. When compared to the metropolitan fringe and its 62,8% growth rate, the T-test tells us to accept the growth rates as equal (significance 2-tailed 0,184; equal variances not assumed).

## 5.3 Commuting patterns

*H3: The commuting patterns between counties have shifted from a core – periphery model in 1970 to a sub-center – sub-center model in 2008.*

The Place of Residence and Place of Work of a worker may differ, meaning he or she is forced to commute. The spreading out of employment over Michigan's counties has led to the assumption that commuting patterns should change too. Instead of a periphery to core model, a sub-center to sub-center model is believed to have come into place. This assumption is tested with the ACS data of PoW and PoR. Using database and spreadsheet software, a cross table is designed that contains the number

of commuters that counties send out and receive. Through selecting the counties by their type as being part of the urban core, urban fringe or rural areas, the sub-totals of commuters between the areas have been calculated. The numbers can be seen in table 5.3.

Overview of origin and destination of Michigan's commuters, 1970 and 2008							
Place of Work		1970		2008*		Growth	
State of Michigan		<i>Total</i>		2862360		4303648	50,4%
<b>Core counties</b>	<i>All workers</i>	2348143		3331742		41,9%	
	<i>Workers originating from other county type</i>	81672		257779		215,6%	
	<i>Share of state total</i>	82,0%		77,4%		-4,6%	
Origin of workers	Core county	2266471	96,5%	3073963	92,3%	35,6%	
	Fringe county	80172	3,4%	247611	7,4%	208,8%	
	Rural county	1500	0,1%	10168	0,3%	577,9%	
<b>Fringe counties</b>	<i>All workers</i>	309418		583680		88,6%	
	<i>Workers originating from other county type</i>	22382		98786		341,4%	
	<i>Share of state total</i>	10,8%		13,6%		2,8%	
Origin of workers	Core county	19023	6,1%	90737	15,5%	377,0%	
	Fringe county	287036	92,8%	484894	83,1%	68,9%	
	Rural county	3359	1,1%	8049	1,4%	139,6%	
<b>Rural counties</b>	<i>All workers</i>	204799		388226		89,6%	
	<i>Workers originating from other county type</i>	1949		16639		753,7%	
	<i>Share of state total</i>	7,2%		9,0%		1,9%	
Origin of workers	Core county	134	0,1%	4620	1,2%	3347,8%	
	Fringe county	1815	0,9%	12019	3,1%	562,2%	
	Rural county	202850	99,0%	371587	95,7%	83,2%	

\* Contains data from 2000 for 19 rural counties

Table 5.3: Commuting flows between Michigan's metropolitan core and fringe areas. (Source: Census Bureau data)

A distinction is made between workers that commute to a different type of county (inter-regional commuters), and the total number of workers in each group of counties (inter and intra-regional commuters summed up). Table 5.3 presents some remarkable developments. First of all, the metropolitan core counties are relatively losing employment to the metropolitan fringe and rural counties. This is in line with the results found earlier, in the first paragraph of this chapter. The metropolitan fringe and rural counties experienced employment growth of almost 90%, leaving the metropolitan core behind at only 41,9%. A consequence of the suburbanization can be seen in the increased share of workers that commute from the metropolitan fringe and even rural areas, to the core.

Looking at the fringe counties, we see that in 1970 92,8% of the workers originated from the same type of counties. By 2008, this figure dropped to 83,1%, and the new workers are mostly originating from the metropolitan core. This can be explained as a leveling of the playing field of counties as employment centers. However, the share of workers in the metropolitan core that lives in the fringe counties has grown from 3,4% to 7,4%. This is likely to be a result of the suburbanization. When we look at the numbers for the rural counties, some huge increases are reported. They may be result of very small numbers at the start of the analysis, but the growth is significant nonetheless. Just like the metropolitan fringe, the rural counties see more workers coming in from the metropolitan core. Besides

that, the rural counties and metropolitan fringe are exchanging more workers in 2008 than they did in 1970.

To assess the validity of the hypothesis, we distill the relevant groups of counties from table 5.3, and compare them in figure 5.4. The assumption is a shift from inter county-type commuting to a model where intra county-type commuting is of increased importance. Because the group that commutes fringe to fringe is intra county-type commuter, we regard them in relation to the total number of commuters, and that of between core and fringe to the total of inter county-type commuters.

<b>Commuting flows between Michigan's metropolitan core and fringe areas</b>					
		<b>1970</b>		<b>2008</b>	
		Commuters		Commuters	
	State total	2862360	100,0%	4303648	100,0%
Excl. locally employed	Fringe to fringe	19970	0,7%	60737	1,4%
Incl. locally employed	Fringe to fringe	287036	10,0%	484894	11,3%
State total inter county-type		106003	3,7%	373204	8,7%
	Core to fringe	19023	17,9%	90737	24,3%
	Fringe to core	80172	75,6%	247611	66,3%

Table 5.4: Commuting flows between Michigan's metropolitan core and fringe areas. (Source: Census Bureau data)

In that light, it is important to notice that the group of inter county type-commuters as a share of the total number of commuters has grown from 3,7% to 8,7%. The doubling share of fringe to fringe commuters (excluding locally employed people) is an interesting development. It is even more remarkable when the people that live and work in the same fringe county is taken into account, because they are a large group. From 1970 to 2008, their share has risen with 1,4%. The fringe to fringe traffic that does cross county borders has risen with 0,7%, but from a much smaller initial share. Although the growth of the group of people working in a metropolitan fringe county is not spectacular, this does mean that an increasing portion of them works in another metropolitan fringe county.

Finally, the streams of traffic between the metropolitan core and fringe are reported in the table. A growing number of residents from the metropolitan core has started commuting to the metropolitan fringe, meaning that the fringe is creating so much employment that it is drawing workers from the old central cities. The growth of employment in the fringe counties can also be seen back in the shrinking share of commuters towards the metropolitan core counties.

## 5.4 Discussion

After the first hypothesis, on the distribution of population and employment had to be rejected, the changes this thesis tries to identify seem unlikely. However, the job growth in the metropolitan fringe has been found to be quite a lot higher than it has been in the metropolitan core, a fact that cannot be explained in the old paradigm of mono-centric city systems. If this growth keeps up in the future, a next study is likely to find a poly-centric city system. The test that was run to compare PoW/PoR ratios in the metropolitan core and fringe areas had to be rejected as well. However, the maps that were discussed in the first part of paragraph 5.1 have shown that the exodus of population may have caused an artificially high ratio of jobs to people in the central cities.

Finding that the second hypothesis, on industrial dispersion, was right may have important implications for the urban structure in Michigan. As manufacturing plants are leaving the metropolitan core counties, a much more spread out landscape of production is created. These manufacturing plants are likely to be followed by a chain of suppliers and facilitating services, meaning a change in the distribution of employment. The finding that statistically seen, manufacturing employment growth in rural areas is just as fast as it is in the metropolitan fringe areas only emphasizes this development.

The previous finding raised expectations to find a shift in commuting patterns. The flow of commuters between metropolitan fringe counties has doubled; a development that seems to make the case. The doubling of commuters from the fringe to the core can be explained by the nature of work that remains in the central cities, which is often service-related. Strongly relying on face-to-face contact these jobs stay where they are. As soon as a worker in this sector decides to sub-urbanize, he is a new fringe-to-core commuter. Finding that only one in ten of those that both works and lives in the urban fringe, commutes to another county in the urban fringe, does explain why no larger rise in sub-center to sub-center commuting could be found.

All together, the evidence points to an increasingly level playing field of counties, with the central counties losing importance as center of employment, and the fringe and rural counties experiencing rapid growth.

## Chapter six: Conclusions

Based on the information that has been gathered in chapter five, and the theories and facts that have surfaced in the other preceding chapters, the most important findings are discussed here. That means the answering of the research-questions, to the extent this is possible. An evaluation of the data and research methods that have been used is also included, as well as some leads for future research.

### 6.1 Conclusions

The decentralization of population has been well documented, and the same effect has been found for the state of Michigan. The decentralization of employment is another matter. The large loss of employment in Detroit is highly significant to the relative decentralization of employment that is observed. The problem is that the loss of employment in that city is not proved to be a result of decentralization. It may have been a result of local economic stagnation just as well. An interesting thought is that Detroit's failure as a primary city has caused the population to spread out as fast as they do, which creates a downward spiral that has its impact on the surrounding larger area.

This research however was aimed to identify patterns, and not to find the underlying cause(s) for the changes at hand. The first trend is that the population is gradually leaving the metropolitan central areas, and this should be seen as answer to the first research-question. The theory and context chapters have uniformly indicated that the decentralization of population cannot be expected to halt any time soon.

A second pattern, with regard to the second research question, is that the non-metropolitan areas turned out to create jobs at a higher speed than the metropolitan ones, as might have been expected based on the literature. What came as a complete surprise is that the counties that are not adjacent to a metropolitan area were creating jobs at a faster rate than those that are adjacent to a metro area. The reason for this might be that employment is leapfrogging ahead of residential development, creating employment relatively far away from the central cities. The large surfaces required to establish a manufacturing plant may play a role here. Sub-centers of employment as described by Garreau (1992) were expected to be found in the metropolitan fringe, but could not be identified with the methods and data used in this research. A strong growth of employment was found, but the expected change in ratio of residents and employment could not be traced.

Research question three, on the specialization of sub-centers, turned out to be impossible to answer in this research set up. This is disappointing, as theory explains specialization is of high importance to the success of employment centers, and discovering specializations in specific types of counties would have shed light on the economic functioning of the state. However, finding the employment centers alone turned out to be hard enough, and the data that is required to identify specializations was too complicated and diffuse to handle with the technological knowledge and time available. However, the state of Michigan has been chosen as case for this thesis because of the large manufacturing sector, a characteristic was confirmed to be important by theory and context. That common specialization has been picked up to shed further light on the decentralization of employment.

The finding that manufacturing-industry employment is leaving the highly urbanized areas at a high speed, establishing in the completely rural areas even faster than they are in the counties that are adjacent to the metropolitan areas explained the decentralizing process that was identified. Perhaps it is because of this high speed decentralization over long distances that a more equal spread of employment is created, without the formation of actual centers of employment at the scale of counties.

Then coming back to the fourth research-question on shifting commuting patterns: the presumed shift of commuting patterns from a central-periphery to a sub-center – sub-center model could not be proved statistically, but the evidence gathered indicates that the state of Michigan is slowly moving towards such a model. The analysis found that 9 out of 10 people that work in a metropolitan fringe county do so in their own county, what could blur some of the results that were expected.

The main research question set out at the beginning of this thesis was: *How has the spatial economic structure of the state of Michigan changed over the period 1970-2008 as a consequence of decentralization?*

The information that was gathered indicates a strong decentralization of population, being the first component of the spatial economic structure. For employment, a U-shaped growth pattern was found for counties from a large metropolitan area to semi-rural areas, to extremely rural areas, with the exception of the central metropolitan county in which Detroit is located. As growth rates were highest in the most rural parts of the state, a homogeneous spread of employment seems to be developed, instead of a poly-centric based organization.

The nature of work seems determining for its likeliness to decentralize. Manufacturing employment is not forced to remain in the metropolitan areas, and is therefore decentralizing at a fast pace. Jobs in the service industry are expected to decentralize as well, based on the theory that was studied. That is restricted to services that are used on a daily basis, and which do not have a need to be located in the central city with its extensive infrastructure. Only those jobs are tied to the old central cities stay where they are, or at least that seems to be the case for Michigan.

The tendency of employment to leave Michigan's old central cities is against the nature of businesses to concentrate, in order to acquire economies of scale. As Michigan is not the only US city that has experienced strong suburbanization, other cities may experience this decentralization of employment too. On the other hand, Detroit is quite unique in its economic adversity, which may cause Michigan's case to be special.

## 6.2 Evaluation

A recurring issue in this research is the question of scale. The literature brings forth the ideas of Garreau (1992) and Rothblatt (1994) on new urban systems. When we regard the Detroit metropolitan area as strictly the central city and its suburbs, a process of decentralizing employment may have been found towards the edges of the city, as described by Garreau. The reality is that Detroit occupies an area so vast that it has spread over its county boundaries, making it hard to define where the city begins and ends. Another complicating matter is the integration of multiple counties into the same metropolitan area, blurring results even further.

The classification of counties on the rural-urban continuum code was helpful to some degree, but turned out to be far from perfect. Information on the size of the largest urbanized core in a county (or at least the share of urbanized population all together, such as Isserman (2005) uses) is probably of much more use than the total amount of population or the average population density of the entire county.

The lack of complete data is another point at which this research is not perfect. The lack of digital data before the 1970s forced the period of analysis to start here, while the sub-urbanization itself started much earlier. The coming of the ACS as an additional, more frequent source of data on the US population is very welcome, but could not yet be fully exploited because the estimates were not accurate enough at this point in time.

Many forms of research could shed more light on the problem at hand. A comparison of the employment growth in other major metropolitan areas could point out if the loss of jobs in Detroit is unique. A research that is less geographical and more economical of nature could explain what caused the loss of employment in Detroit.

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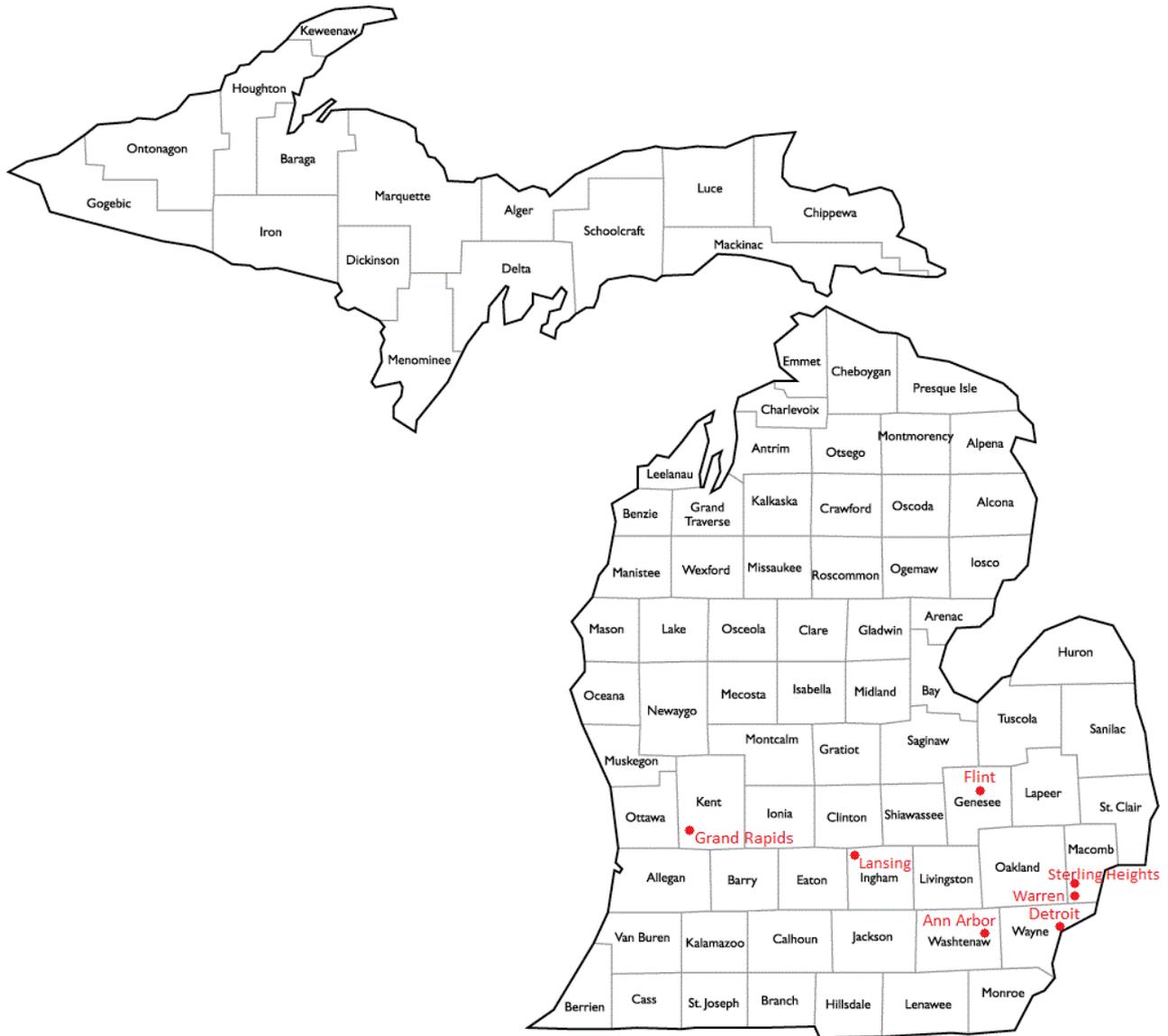
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## Appendix 1: State of Michigan counties by class

Class	<i>Metropolitan counties:</i>
0	Central counties of metro areas of 1 million population or more.
1	Fringe counties of metro areas of 1 million population or more.
2	Counties in metro areas of 250,000 to 1 million population.
3	Counties in metro areas of fewer than 250,000 population.
<i>Non-metro counties:</i>	
4	Urban population of 20,000 or more, adjacent to a metro area.
5	Urban population of 20,000 or more, not adjacent to a metro area.
6	Urban population of 2,500 to 19,999, adjacent to a metro area.
7	Urban population of 2,500 to 19,999, not adjacent to a metro area.
8	Completely rural or less than 2,500 urban population, adjacent to a metro area.
9	Completely rural or less than 2,500 urban population, not adjacent to a metro area.

<i>County Name</i>	<i>1974</i>	<i>1993</i>	<i>2003</i>	<i>County Name</i>	<i>1974</i>	<i>1993</i>	<i>2003</i>
Wayne County	0	0	0	Mecosta County	7	7	6
Oakland County	1	0	0	Montcalm County	6	6	6
Lapeer County	1	1	1	Sanilac County	1	0	6
Livingston County	1	1	1	Tuscola County	6	6	6
Macomb County	1	0	1	Alpena County	7	7	7
St. Clair County	7	7	1	Charlevoix County	7	7	7
Barry County	3	6	2	Cheboygan County	7	7	7
Cass County	6	6	2	Clare County	7	7	7
Clinton County	2	2	2	Crawford County	9	9	7
Eaton County	2	2	2	Emmet County	7	7	7
Genesee County	2	2	2	Gogebic County	7	7	7
Ingham County	2	2	2	Huron County	7	7	7
Ionia County	2	6	2	Iosco County	7	7	7
Kalamazoo County	2	2	2	Iron County	7	9	7
Kent County	2	2	2	Kalkaska County	9	9	7
Newaygo County	6	6	2	Luce County	9	9	7
Van Buren County	2	2	2	Mackinac County	7	7	7
Washtenaw County	3	0	2	Manistee County	7	7	7
Bay County	3	2	3	Mason County	6	7	7
Berrien County	4	3	3	Menominee County	7	7	7
Calhoun County	3	2	3	Osceola County	9	9	7
Jackson County	3	3	3	Otsego County	7	7	7
Monroe County	2	1	3	Presque Isle County	7	7	7
Muskegon County	3	2	3	Roscommon County	9	7	7
Ottawa County	2	2	3	Schoolcraft County	6	6	7
Saginaw County	3	2	3	Wexford County	7	7	7
Allegan County	6	2	4	Arenac County	8	8	8
Lenawee County	4	1	4	Lake County	9	9	8
Midland County	4	2	4	Oceana County	3	8	8
Shiawassee County	8	8	4	Alcona County	9	9	9
St. Joseph County	2	4	4	Alger County	7	7	9
Chippewa County	5	7	5	Antrim County	9	9	9
Delta County	5	7	5	Baraga County	7	9	9
Dickinson County	7	7	5	Benzie County	9	9	9
Grand Traverse County	7	7	5	Keweenaw County	9	9	9
Houghton County	7	7	5	Leelanau County	9	9	9
Isabella County	5	4	5	Missaukee County	9	9	9
Marquette County	5	5	5	Montmorency County	9	9	9
Branch County	6	6	6	Ogemaw County	9	7	9
Gladwin County	8	6	6	Ontonagon County	9	9	9
Gratiot County	6	6	6	Oscoda County	9	9	9
Hillsdale County	6	6	6				

## Appendix 2: State of Michigan counties and cities



State of Michigan Counties and cities of more than 100.000 inhabitants. (Source: Worldatlas)