

Czech University of Life Sciences Prague

Faculty of Economics and Management

Department of Economics



Diploma thesis

**Causes of fall and proposals of rejuvenation of
Detroit urban area**

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CZECH UNIVERSITY OF LIFE SCIENCES PRAGUE

Department of Economics
Faculty of Economics and Management

DIPLOMA THESIS ASSIGNMENT

Hess Václav

Economics and Management

Thesis title

Causes of fall and proposals of rejuvenation of Detroit urban area

Objectives of thesis

The diploma thesis deal with current development and possible future of Detroit Metro. The main goal is to define the most important factors which led the city to the state in which is now. Is it crime which caused population drop or was it caused by declining automobile industry or something completely different? These are questions which are answered in the first part of this work.

The secondary goal is to propose possible development of the city, with regard to researched data and situation in the world. So far the Detroit Metro consume bilions dollars as subsidies to save the city, but with no significant improvement.

Methodology

Methodology involves but is not restricted to collection of data which stem from valid and up to date sources (research articles, educational and government statistic, books). Own research will be based on an econometric model which will be created to find relations between chosen variables that can affect current state and development of the city.

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Lectures on Urban Economics; J. Brueckner; 2011
Urban development the logic of making plans; L. Hopkins; 2001
Globalization and Urban Development; H.W. Richardson; 2005
Detroit Divided; R. Farley; 2002

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Prague November 22. 2012

Declaration of integrity

I hereby declare that I have worked on my Diploma Thesis titled Revitalizing Dying Detroit, Analysis of Urban Transformation in Detroit Metro solely and completely on my own and that I have marked all quotations in the text. The literature and other material I have used are mentioned in the References Section of the Thesis.

Prague,

.....

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I would like to express my gratitude to supervisor of my diploma thesis Ing. Petr Procházka, MSc, Ph. D. for guidance, constructive feedback and general support for my work.

Causes of fall and proposals of rejuvenation of Detroit urban area

Příčiny úpadku a návrhy revitalizace Detroitu

Summary

The diploma thesis is focused on identification of main causes of fall of Detroit Metro and possible revitalization. So far the Detroit Metro consumes billion dollars as subsidies to save the city, but with no significant improvement. Own research is based on statistical methods analysis of time series and an econometric model. Proposals for revitalization of the city are based on socio-economic analysis. This thesis determined financial security in city as main pull factor, respectively median income, jobs offerings, social benefits and relative price of goods and services. Proposals for the restoration of the city put the greatest emphasis on transportation reform, adjustment and stronger support for Neighborhood Stabilization Plan and the reduction of criminality.

Souhrn

Diplomová práce je zaměřena na odhalení příčin úpadku města Detroit a možné revitalizaci. Doposud Detroit spořádal miliony dolarů na svou záchranu, ale bez znatelného pokroku. Vlastní výzkum je založen na analýze časových řad a ekonometrickém modelu. Návrhy na revitalizaci města byly vypracovány na základě socio-ekonomické analýzy. Tato práce odhalila jako hlavní pull faktor finanční zajištění, které město nabízí, respektive průměrný příjem, nabídku pracovních míst, sociální dávky a relativní cenu zboží a služeb v kontrastu vůči ostatním městům. Návrhy na obnovu města kladou největší důraz na dopravní reformu, úpravu a silnější podporu Neighbourhood Stabilization Plan a na snížení kriminality.

Key words

Detroit, Demographics, Michigan, Population trends, Revitalization plan, Socio-economic factors, Urban development

Klíčová slova

Detroit, Demografie, Michigan, Plán revitalizace, Populační trendy, Rozvoj města, Socio-ekonomické faktory

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1 Preface

No city played largest role in shaping twentieth century in United States than Detroit. Detroit was known for its automotive industry, it was not unreasonably called Motor City. The automotive companies that emerged here were the “Big Three” auto makers - Ford, General Motors, and Chrysler. Detroit was centre for immigrants from all corners of the world, especially Afro Americans which now creates majority of total population. Despite its history of prosperity and technical innovations, following the 1967 racial violence, Detroit became the most negatively stereotyped city in the country. The city had lost tens of thousands of manufacturing jobs, had experienced massive white flight and became large city with hollow core. Since 1967 population of Detroit city dropped by one third. Nowadays Detroit remains *axis mundi* for automotive technology and many vehicles are assembled in and near Detroit. Three modern steel mills operate here. But they now employ few blue-collar workers.

First part of thesis deals with history of metropolitan Detroit linked to informed speculations about its future. It provides information about achievements that occurred here as well as about conflicts that made Detroit a metropolis polarized by race and economic class.

Second part of thesis is focused on determination of the main cause of the depopulation in Detroit Metro and the other forces which led the city to the current state of regression.

In the last part of the thesis are mentioned possible solutions and suggestions how to revitalize the city.

2 Goal of the work and methodology

2.1 Goal of the work

The diploma thesis deals with current development and possible future of Detroit Metro. The main goal is to define the most important factors which led the city to the state in which is now. Main hypothesis is that the decline of automotive industry, shift of production to developing countries, was together with high crime the main cause of Detroit decay.

The secondary goal is to propose possible development of the city, with regard to researched data and situation in the world. So far the Detroit Metro consumes billion dollars as subsidies to save the city, but with no significant improvement.

2.2 Methodology

Methodology involves but is not restricted to collection of data which stem from valid and up to date sources (research articles, educational and government statistic, books). Data collection includes characteristics of 42 U. S. cities; all data in tables are available in annexes. These cities were chosen based on their total population, location, automotive industry and availability of data. Majority of statistical data were taken from American Community Survey for years 2000 to 2012. Collected data were processed in MS Excel 2010 and statistical program Gretl. Gretl is free, open-source software package for econometric analysis. Own research will be based on statistical methods analysis of time series and an econometric model which will be created to find relations between chosen variables that can affect current state and development of the city. Besides these methods there were used formulas for selected demographic indicators. In last chapter of literature review are explained statistical and econometrics methods used for own analysis together with chosen variables and hypothesis of influence they have on the model. Proposals for future development are based on results from econometric model and socio-economic analysis of Detroit city.

3 Literature research

3.1 Characteristics of the state of Michigan

Michigan is a Midwestern state of the United States of America. It was named after Lake Michigan. The state is bounded on the south by the states of Ohio and Indiana, sharing both land and water boundaries. Michigan's western boundaries are almost entirely water boundaries, from south to north, with Illinois and Wisconsin, then with Minnesota and Canadian province of Ontario to the north and east (New World Encyclopedia contributors, 2012).

Michigan consists of two peninsulas. The heavily forested Upper Peninsula is relatively mountainous in the west. The state's highest point, in the Huron Mountains is Mount Arvon at 603 meters. The Lower Peninsula of Michigan, to which the name Michigan was originally applied, owing to its shape. The Upper Peninsula is separated from the Lower Peninsula by the five-mile channel that joins Lake Huron to Lake Michigan (New World Encyclopedia contributors, 2012).

Michigan is the largest state east of Mississippi River. Michigan encompasses 58 110 square miles of land, 38 575 square miles of Great Lakes waters and 1 305 square miles of inland waters. And is 11th largest state of the United States (New World Encyclopedia contributors, 2012).

Michigan consists of 83 counties. The biggest counties in the state are Wayne county, with population of almost 2 million people; Oakland county (1.2 million), Macomb county (830 000), Kent county (600 000), Genesee (440 000) and Washtenaw (340 000). The rest of counties is relatively small with population under 200 000 inhabitants. These counties are distinctly different in shape, size, number and structure of population. State government is decentralized among three tiers – statewide, county and township. Michigan's total population was 9 895 622 on July 1, 2013. According to the United States Census Bureau, since April 2000, total population of Michigan dropped about 0.6 percent (New World Encyclopedia contributors, 2012).

While Michigan ranks first among the states in production of motor vehicles and parts, it is also a leader in many other manufacturing and processing lines, including

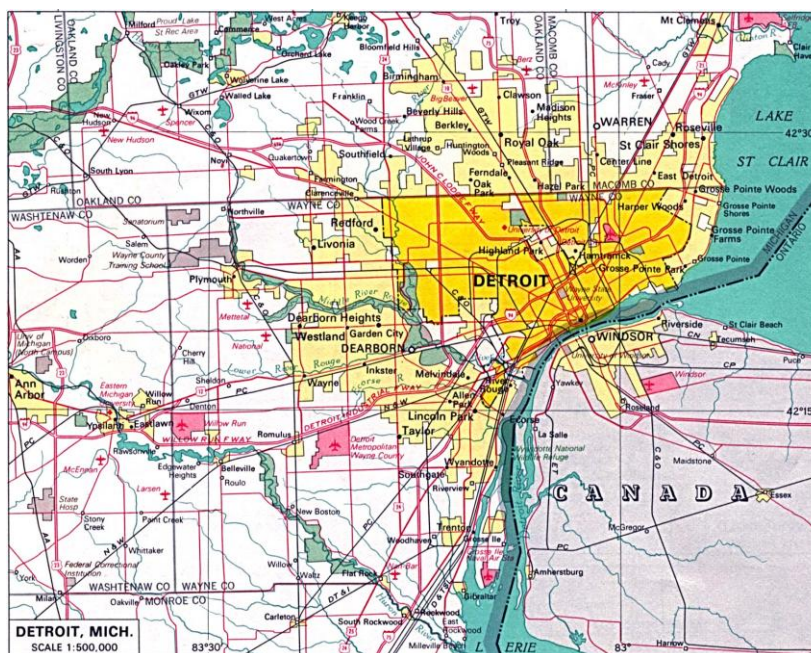
prepared cereals, machine tools, airplane parts, refrigerators, hardware, and furniture (Pearson Education, 2013).

The state produces important amounts of iron, copper, iodine, gypsum, bromine, salt, lime, gravel, and cement. Michigan's farms grow apples, cherries, beans, pears, grapes, potatoes, and sugar beets. Michigan's forests contribute significantly to the state's economy, supporting thousands of jobs in the wood-product, tourism, and recreation industries. With 10 083 inland lakes and 3 288 mi of Great Lakes shoreline, Michigan is a prime area for both commercial and sport fishing (Pearson Education, 2013).

3.2 Detroit: Location

Detroit is the largest city in the U.S. state of Michigan and the eleventh-largest city in the country with land area around 138 sq miles. In Detroit live 701 475 residents and a metropolitan population is 5 times that size. It is the oldest major city west of the original colonies. In the picture below you can see the size and location of Detroit city (Adavameg Inc., 2014).

Picture 1 - Map of Detroit city



Source: (Mappery, 2014)

Detroit is located in southeast Michigan, set on the Detroit River between Lake Huron and Lake Erie. Metropolitan area includes the St. Clair River, Lake St. Clair and the west end of Lake Erie. The land is nearly flat, rising gently north-westward from the waterways then becoming rolling terrain. The climate is influenced by the city's location near the Great Lakes and its position in a major storm track. Climatic variations also arise from the urban heat island, the effect becoming most apparent at night, when temperatures downtown will remain significantly higher than those in suburban locations. The city enjoys four distinct seasons. Winters are generally long and cold, and storms can bring combinations of rain, snow, freezing rain, and sleet with heavy snowfall possible at times. Annual snowfalls average around 45 inches. During the summer, storms pass to the north, allowing for intervals of warm, humid weather with occasional thunderstorms that are followed by days of mild, dry weather. Air pollution coming from heavy industry in the area is said to have been minimized with state-of-the-art pollution control efforts (Adavameg Inc., 2014).

3.3 Detroit: History

The City of Three Flags

Detroit was founded in 1701 by the French military leader and trader Antoine Laumet de la mothe Cadillac. It was originally called Ville d'Étroit which means "city of the strait." For the next 60 years, Detroit remained a small frontier settlement with around a hundred people. The economy was centered on the fur trade and farming (Columbia university, 2000).

In 1760, as part of the treaty at the end of the seven years long war, Britain obtains Detroit from the French. In 1796 the British surrender Detroit to Captain Moses Porter of United States Army (MULLIN, Ren Farley).

Rise from ashes

Fire in 1805 destroyed nearly all of the several hundred buildings in the town. A river warehouse and brick chimneys of the wooden homes were the sole structures to survive. Surprisingly no one died in Great Fire. After destruction, Detroiters did not abandon their city. The settlement was rebuilt from a design by Pierre Charles L'Enfant

for Washington, D. C.: a park in the middle and wide streets radiating outward in a hub-and-spoke pattern. As Detroit grew, additional hexagons could be added parallel to the original one. This idea was adopted then eventually abandoned and a grid street pattern was superimposed over the hexagonal design (Adavameg Inc., 2014).

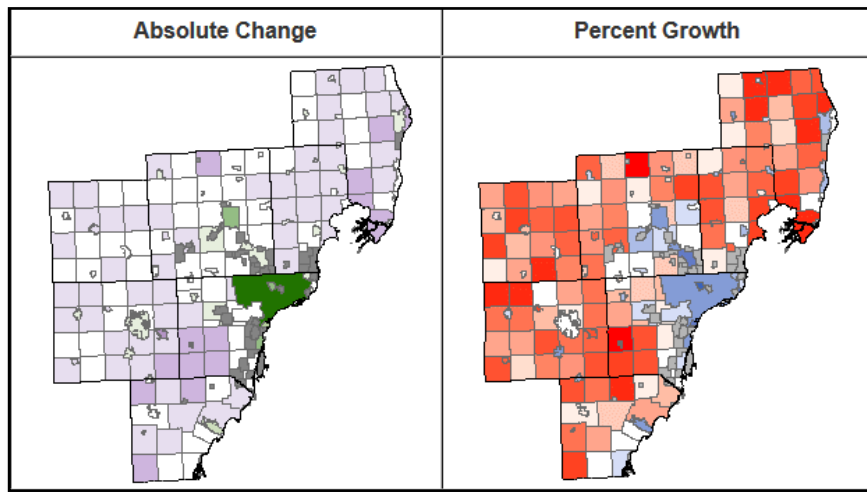
Detroit was incorporated as a town in 1802 and as a city in 1815. Detroit was first the territorial and then the state capital from 1805 to 1847. But in 1847 the state capital was moved from Detroit to its permanent location in Lansing (Columbia university, 2000).

Motor age

In 1896, a thriving carriage trade prompted Henry Ford to build his first automobile in a rented workshop on Mack Avenue, and in 1904, the Ford Motor Company was founded. Along with Ford, such automotive pioneers as W.C. Durant, Walter P. Chrysler, Ransom Olds, Henry Leland, and the Dodge brothers laid the foundation for the companies that emerged as the “Big Three” auto makers—Ford, General Motors, and Chrysler—by the latter half of the twentieth century (Adavameg Inc., 2014).

Following graph shows population changes in 1900-1910 in Detroit region and adjacent counties. Population in Detroit increased, people moved from farms to cities. Purples and reds indicate population declines, while greens and blues indicate population gains. The left graph shows absolute changes while the right graph shows percentage changes in the area.

Picture 2 - Population changes in Detroit region (1900-1910)

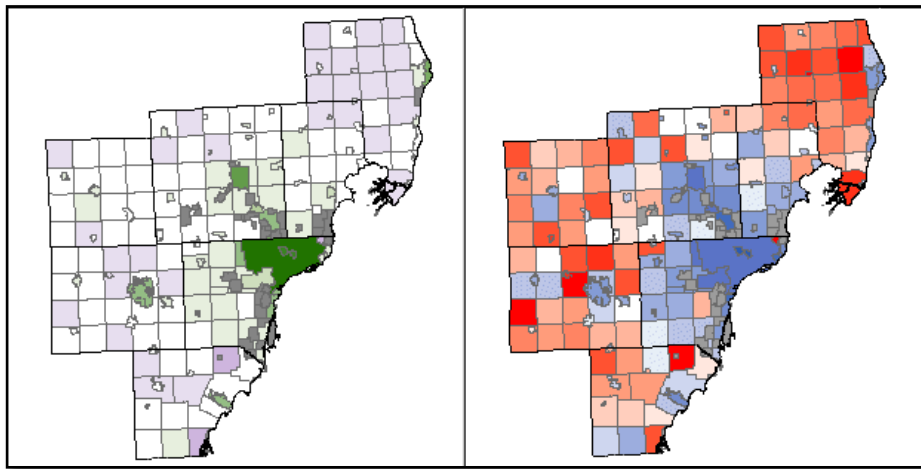


Source: (HUMBAD, 2011)

At the beginning of World War I and continuing for several decades thereafter, thousands of African-Americans came to Detroit looking for work. Many of the early migrants had been recruited by “big three” auto makers. African-Americans were not the only people migrating to Detroit during and after the First World War Working-class whites came from the South in search of the same jobs as African-Americans (University of Michigan, 2007).

Following graph shows population changes in 1910-1920 in Detroit region and adjacent counties. The city's population nearly doubled between 1910 and 1920, rising from 465 766 to 993 678, with most of that increase coming after the war began. By that time Detroit was the fastest growing metropolitan area and the fourth largest city in United States. Purples and reds indicate population declines, while greens and blues indicate population gains. The left graph shows absolute changes while the right graph shows percentage changes in the area.

Picture 3 - Population changes in Detroit region (1910-1920)

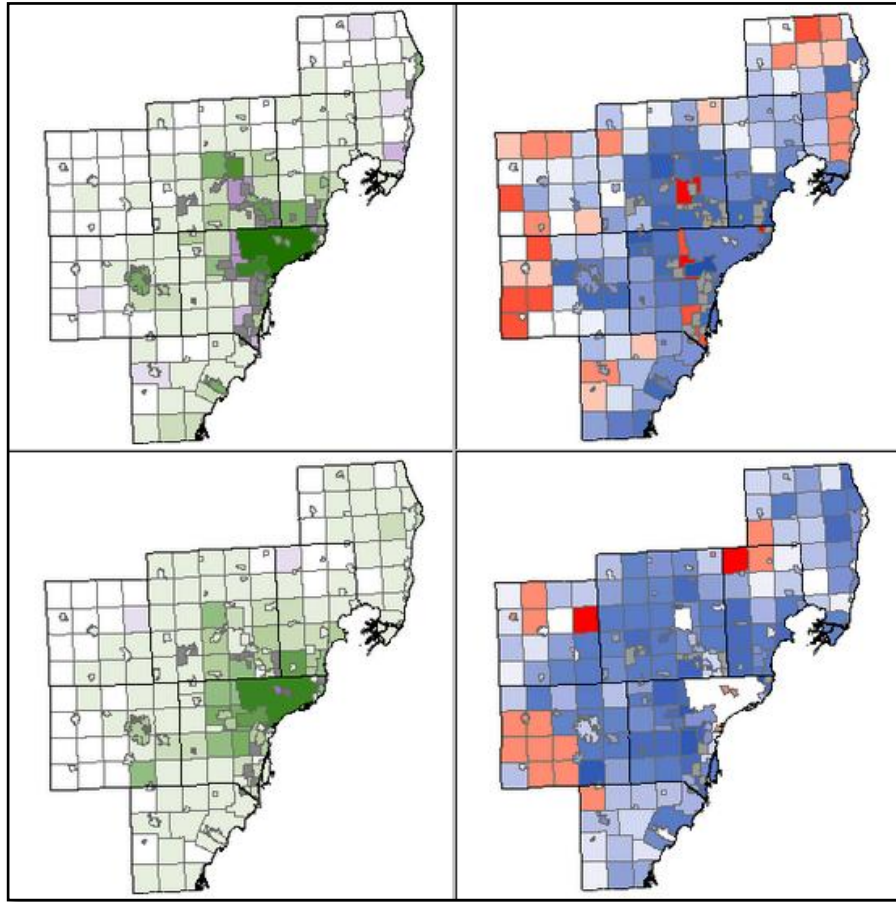


Source: (HUMBAD, 2011)

In 1925 Detroit was, in the words of one historian a “total industrial landscape,” the city was home to three thousand major manufacturing plants, thirty-seven automobile manufacturing plants, and two hundred and fifty automobile accessory manufacturing plants. Factories employed over three hundred thousand people. The prosperity and opportunity Detroit seemed to offer attracted tens of thousands of migrants of all classes and skills, especially African Americans. It turned the Motor City into one of the most racially and ethnically diverse places in America (SURGUE, 2011).

Following upper graph shows population changes in 1920-1930 and lower graph shows population changes in 1930-1940 in Detroit region and adjacent counties. Detroit population continued with its rapid growth slowing down in late thirties. Purples and reds indicate population declines, while greens and blues indicate population gains. The left graph shows absolute changes while the right graph shows percentage changes in the area.

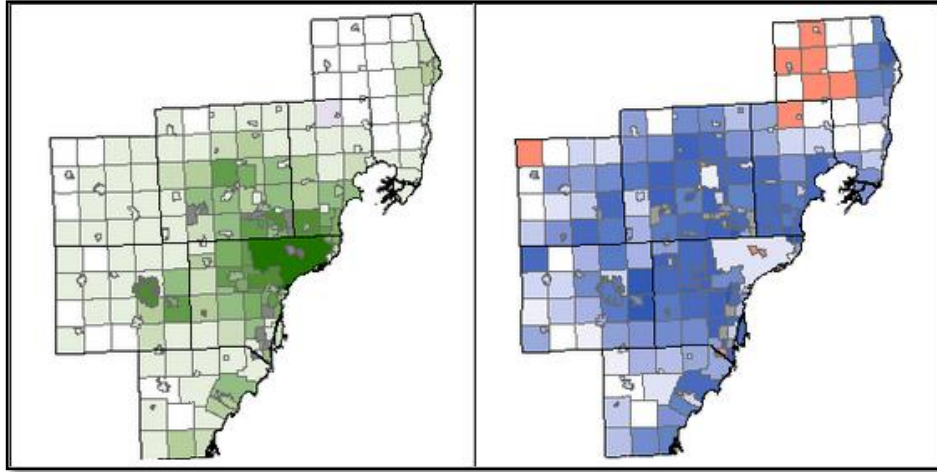
Picture 4 - Population changes in Detroit region (1920-1930 and 1930-1940)



Source: (HUMBAD, 2011)

During World War II, Detroit was leading producer for the military, Ford opened a bomber factory and Chrysler a tank plant, leading to a new nickname for Detroit—"the arsenal of democracy." World War II had slight positive impact on population growth in Detroit region. The following graph shows population changes in 1940-1950 in Detroit region and adjacent counties. Purples and reds indicate population declines, while greens and blues indicate population gains. The left graph shows absolute changes while the right graph shows percentage changes in the area (Adavameg Inc., 2014).

Picture 5 - Population changes in Detroit region (1940-1950)

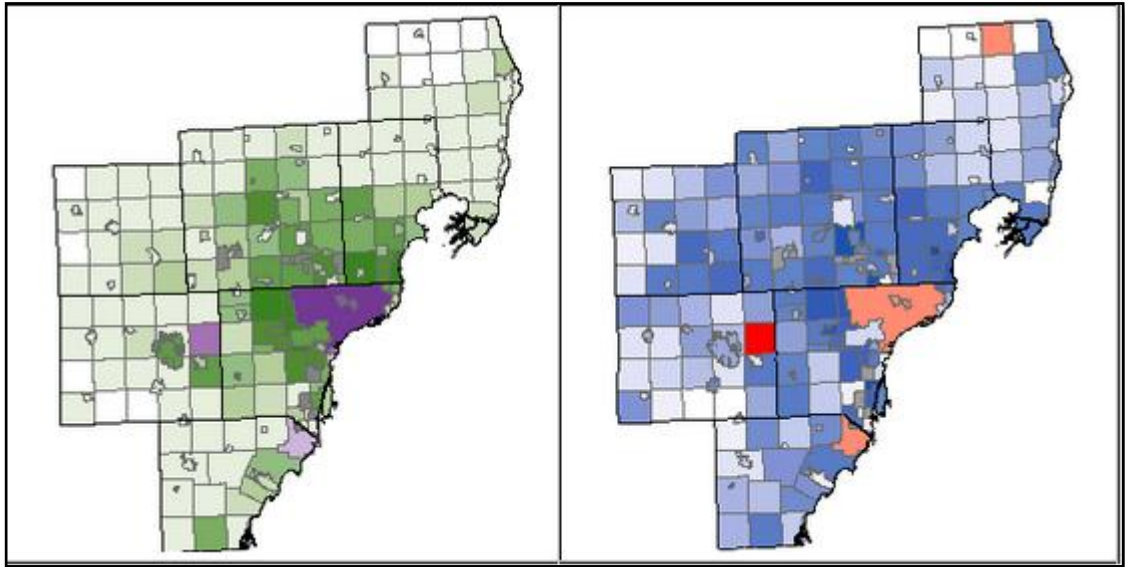


Source: (HUMBAD, 2011)

By the 1950, Detroit had become the fifth largest city in the United States, home to nearly two million people. But in the midst of that prosperity, the auto industry restructured its operations. Between 1948 and 1967, when the auto industry was at its economic peak, Detroit lost more than 130 000 manufacturing jobs. The auto industry began to decentralize its production, building new plants in suburban “Greenfields” and in the small towns of the upper Midwest and, increasingly, the Sunbelt. Many smaller auto-related manufacturers also left the city in search of low-wage workforces and open land for new factories. At the same time, the auto industry experimented with new labor saving technology—called “automation”—that replaced many assembly line jobs with new machinery. The results were devastating. Many of the large, early twentieth-century factory buildings in the city emptied out (SURGUE, 2011).

The following graph shows population changes in 1950-1960 in Detroit region and adjacent counties. This era can be called the beginning of Detroit decline and start of suburban ascendancy. In this decade the population of Detroit decreased by 10 percent. Purples and reds indicate population declines, while greens and blues indicate population gains. The left graph shows absolute changes while the right graph shows percentage changes in the area.

Picture 6 - Population changes in Detroit region (1950-1960)



Source: (HUMBAD, 2011)

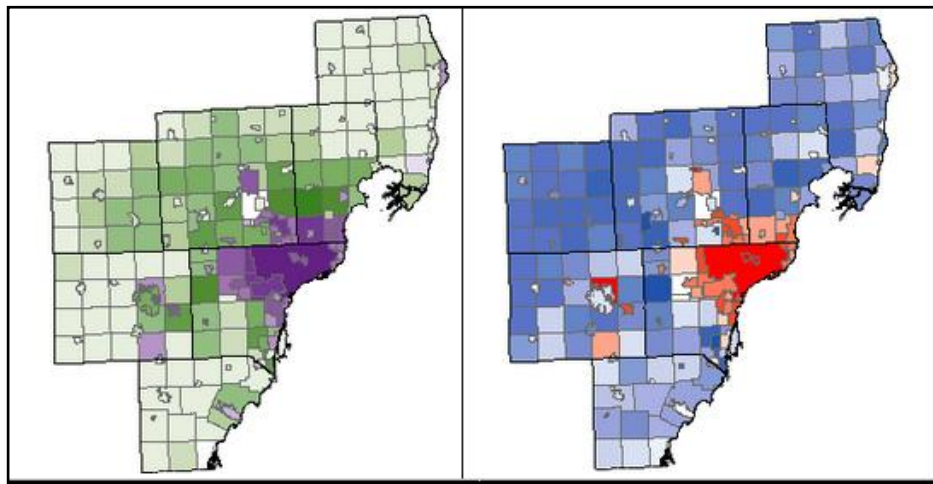
Racial tension

Detroit's deindustrialization came at a moment when the city's white population was suburbanizing. Between World War II and the 1960s, the city's African American population rose exponentially, as hundreds of thousands of blacks were lured to the city by the promise of high-paying industrial jobs. Just as they arrived, those jobs, especially the entry-level positions that had served as the first rung on the economic ladder, were disappearing. By 1967, when Detroit erupted with one of the worst race riots in American history, the city had already lost tens of thousands of manufacturing jobs, had experienced massive white flight, and had seen many of its neighborhoods (especially those that had been built in the shadow of the major automobile plants) gutted by depopulation and disinvestment (SURGUE, 2011).

To resolve issues of which were seen as root causes of race problems such as education, employment, housing, and economic development, the organization New Detroit was founded. (Adavameg Inc., 2014) Revitalization projects have helped Detroit's downtown but not brought significant benefits to the city at large. Despite the effort 32 percent of population left the city by the end of twentieth century (Columbia university, 2000).

The following graph shows population changes in 1970-1980 in Detroit region and adjacent counties. Since 1950 the population of Detroit decreased by 33 percent. Purples and reds indicate population declines, while greens and blues indicate population gains. The left graph shows absolute changes while the right graph shows percentage changes in the area.

Picture 7 - Population changes in Detroit region (1970-1980)



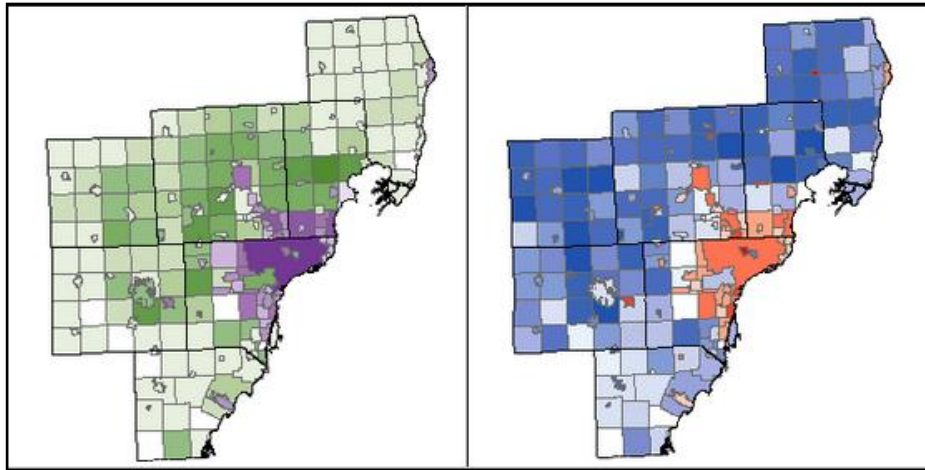
Source: (HUMBAD, 2011)

Detroit's problems remain

By the end of twentieth century Detroit's image had been completely transformed from the mighty engine of American capitalism to the embodiment of America's urban woes. Partly because Detroit's mayors in common with mayors of other large "rust belt cities," oversaw a city in which white residents fled to the suburbs and Detroit went into a severe economic decline. Although the fortunes of the auto industry eventually rose again, especially during the economic boom of the 1990s and the growth in popularity of sport utility vehicles, the „Big Three“ would continue to struggle for market share in an economy increasingly dominated by overseas manufacturers. Detroit, already weakened by decades of disinvestment and depopulation, fared badly and was linked with words like "crime," "decay," and "arson." The Motor City was nearly completely abandoned by whites (who today comprise just a little over 10 percent of the city's population) (SURGUE, 2011).

The following graph shows population changes in 1990-2000 in Detroit region and adjacent counties. Detroit population is in steady decline. Purples and reds indicate population declines, while greens and blues indicate population gains. The left graph shows absolute changes while the right graph shows percentage changes in the area.

Picture 8 - Population changes in Detroit region (1990-2000)



Source: (HUMBAD, 2011)

The early years of the twenty-first century saw mixed results in Detroit's resurgence while several large-scale development projects, including three new casinos, continued downtown's transformation, the neighborhoods continued to struggle with problems of blight, poor city services and declining population (Adavameg Inc., 2014).

Nowadays metropolitan Detroit is still home to the Big Three headquarters, but the city's population has been in steady decline. In 2012 went down to 701 475 inhabitants from 1 849 568 in 1950 when Detroit was at its peak. Its job base continues to shrink; the city's overwhelmingly African-American population is largely impoverished and unemployed. The region generally remains grossly segregated. White, wealthy, suburban neighborhoods are separated by canals and freeways from poor, largely minority areas. All neighborhoods have watched property values slide as the foreclosure crisis hit. At the beginning of the twenty-first century, boomtown Detroit is a distant memory, visible only in the old factory buildings and rubble-strewn lots that were once magnets of opportunity (SURGUE, 2011).

3.4 Detroit: Demographics

The current population of the city of Detroit is estimated to be about 701 475, which is a decrease of about 0.72% from the last record of the population. Detroit is the most populous city in the state of Michigan and the eighteenth-most populous city in the entire country of the United States of America. Based on the total land area and the total population of the city, the population density of Detroit is about 5 055 people per square mile (Worldpopulationstatistics, 2013).

The city of Detroit experienced a sharp 25% population decline over the last decade, a loss of over 237,500 residents. Only New Orleans and Cleveland recorded similar population decline. Population loss remains a fundamental challenge to the well-being of communities in Detroit. Since areas experiencing the greatest population loss are largely home to low-income and minority communities, these groups are disproportionately impacted by issues such as the discontinuation of basic services and declining property values resulting from vacancy, blight, and an associated rise in criminal activity (Metropolitan Opportunity Unit, 2012).

Population by gender

Historically, the number of female residents in Michigan has outnumbered the male residents (51% to 49%). In Detroit, the number of females is slightly higher than the state average with females comprising 52.6% of the population (City of Detroit ITS/Communications and Creative Services Division, 2014).

Population by age group

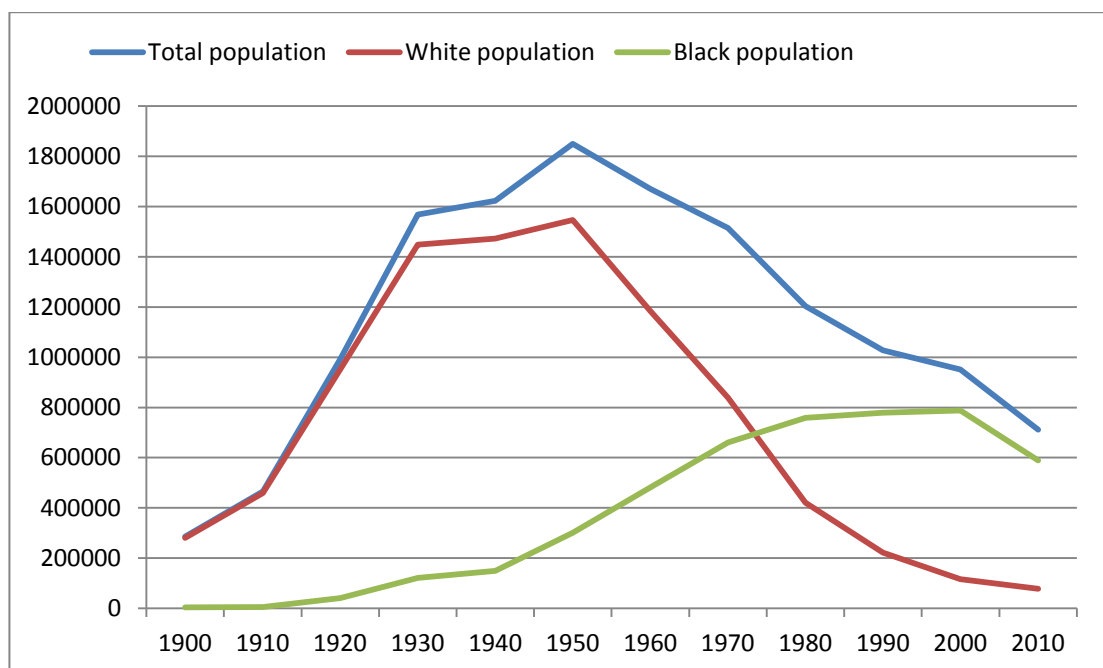
Along with its population problem, Detroit also has a demographics problem with a wide age distribution. The number of young people in the metro is shrinking; the city of Detroit struggles to attract young professionals to contribute to the economic regeneration of the region. Detroit metro residents are predominantly above the age of 35; individuals aged 35 and over comprise 55% of the total regional population and were the only age cohort to experience growth over the decade. The population under the age of 35 decreased by 12%, while the population over 35 increased 5%. As a result, the largest cohort, aged 35 to 64, grew from 39% to 42% of the metro population over

this period. The fastest growing population in the metro region is over 65, comprising 13% of the population in 2010, an increase of 6% since 2000 (Metropolitan Opportunity Unit, 2012).

Historical population of Detroit

In 1950, Detroit was the 4th largest city in the country with population at 1.86 million, but its population has been in decline for the past 60 years. Thanks to this decline, Detroit now has a large number of abandoned buildings and homes and the area is dealing with urban decay. Nowadays Detroit’s population is close to the same size now as it was in 1910, before the city’s automotive boom began. The population suffered a heavy fall from 2000 which stopped in 2010. In 2014 the population is slightly above 700,000 (World Population Review, 2014).

Graph 1 - Population in Detroit



Source: (U. S. Department of Commerce, 2012)

Population by ethnicity

The composition of the Detroit metro area remains starkly divided: a lower income and predominantly black central city surrounded by wealthier, white suburbs.

The majority population in Detroit city is Black or African American group, making up about 83 percent of the population. The next largest demographic with 8 percent is the white group. The Hispanic or Latino group makes up about 7% of the population. The rest 2 percent are formed by other ethnicity groups. Blacks and African Americans make up only 13% of the state's population as a whole (Worldpopulationstatistics, 2013).

Although Detroit's population is shrinking, the Latino population is growing. Many Latinos live and work in Southwest Detroit, sometimes called Mexican town, and operate a flourishing business corridor along West Vernor Highway. With 130 restaurants, 30 bakeries, and 25 markets and specialty food stores, Southwest Detroit is becoming the equivalent of the Arab-American business center in nearby Dearborn (Forbes, 2014).

3.5 Detroit: Economy

The Detroit economy is in the midst of an unprecedented transformation. In less than one decade Michigan moved from a wealthy and prosperous state to one of the poorest (TOBOCMAN, 2012). The regional assets that made Detroit the 20th Century's leading manufacturing centre can no longer create competitive advantages to sustain in global economic leadership of the 21st Century. (EconomyWatch) Automobile manufacturing still continues to be primary force in Detroit economy. The auto industry had stabilized during the last three years. Auto sales have increased from a low annual rate of just 9.0 million units in 2009 to 14.4 million units in 2012. Metropolitan Detroit continues to be the world headquarters for General Motors Corp., Ford Motor Co., DaimlerChrysler Corp., and Volkswagen of America. However in recent year's dependence on the auto industry has decreased. More than 75 percent of the labor force is employed in non-manufacturing jobs in such areas as research and development; law; financial services; accounting; computer services and personnel and clerical support. The Henry Ford Health System is the sixth largest employer in the state and is major research center. Detroit also ranks among the five major financial centers in the United States (Adavameg Inc., 2014).

Job situation and income

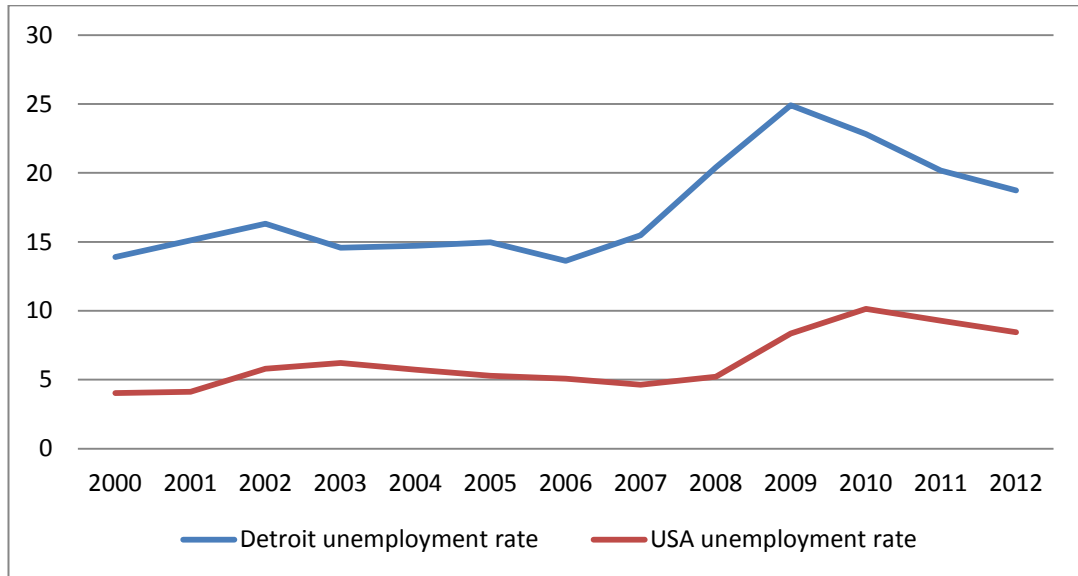
The Detroit market area's labor market stalled somewhat in the second half of 2012. Manufacturing gains continued at an above average rate versus the national economy, but the service sector fell into decline as the year wore on. Detroit has had a taller hill to climb out of recession than many regions, as it was hit hardest by the auto industry's collapse and also suffered housing market damage. Volatile service and retail sector employment trends are therefore not surprising in light of more easily shaken consumer and business confidence. Some good news on the national front is that consumers continue to buy cars. And with manufacturing jobs still being created, the income base is growing. It may take more time for that income to flow through to generate service sector hiring on a consistent basis, but Detroit does have labor market foundations in place to take its cues from a stronger national economy in 2013 and resume its labor market healing (PNC Financial Services Group, 2013).

The median household income in the region declined 25 percent between 2000 and 2010, representing the steepest income decline observed among the 50 largest metros in the country. In the 2000, median income in the Detroit metro was ranked 11th highest, by the 2010 it had fallen to 38th among the 50 largest metros in United States. Coupled with the sharp income decline, large income gap persist between whites and racial and ethnic minorities. The United States now has the third worst income inequality among advanced industrial nations and Detroit ranks s the 35th lowest in income equality among the 50 largest metros in the country. Median household income for black households in Detroit metro is 44% less than white households (Metropolitan Oportunity Unit, 2012).

The unemployment in Detroit remains still high even though unemployment rate continues to fall since 2009 when it reached 24.9 percent. In the end of 2013 the unemployment rate was around 15 percent. Unemployment disparities persist in Detroit; black workers are nearly twice more likely than white workers to be unemployed. Between 2000 and 2010 the employment losses were concentrated among lower-paying jobs. Over this period, an estimated 280 000 jobs were lost: 75% of these jobs were in construction and manufacturing. However, sizable job growth was observed in other

sectors such as health care and social assistance (20%), educational services (44%) and real estate, rental and leasing (16%) over the same time period adding nearly 80 000 jobs in the metro region. Detailed comparison of Detroit and United States unemployment rate is showed in the graph below (Metropolitan Oportunity Unit, 2012).

Graph 2 - Unemployment in Detroit and US



Source: (United States Department of Labor, 2014)

Over the last decade, poverty rose more rapidly and became more concentrated in the city of Detroit. After a decrease in poverty in the 1990s, the Detroit metro experienced a significant (57%) increase in poverty over the last decade, from 11% to 17%. As in many metros nationwide, the Detroit region has experienced an increase in poverty in the suburbs since 2000. However, concentrated poverty in the city remains a persistent and pervasive issue. Within the city of Detroit, one in three residents is living in poverty (34.5%), while surrounding counties have lower poverty rates (Metropolitan Oportunity Unit, 2012).

Real estate market

Detroit’s housing market appears to have stabilized after posting declines considerably worse than the national average. Home sales are still searching for momentum, and stabilized prices may provide support toward that end. Given increases

in affordability and a continuing low interest rate environment, existing home sales are likely to see upward movement in 2013 (PNC Financial Services Group, 2013).

Detroit’s housing market is highly affected by depopulation of the city center. The population of the city of Detroit declined by 23 750 annually between 2000 and 2010. The population outflow created abandoned areas in the city. By 2010, more than half of all zip codes were experiencing severe foreclosure rates. These abandoned properties become problems when they attract crime and disorder, thus reducing value of surrounding buildings. House value has been decreasing since 1990. Even though most houses In the Detroit metro are affordable to households (only 9% of housing units). Housing is considered affordable when it does not exceed 30% of household income. Furthermore, these affordable housing units are concentrated in a small number of neighborhoods. The overall availability of affordable housing, and its location with respect to important facets of opportunity including access to public transit, jobs, and services, remains important issues for the region’s low-income residents (Metropolitan Oportunity Unit, 2012).

Table 1 - Detroit economic data from ACS 2008-2012 with U.S.

Economic indicator	Detroit, MI	Michigan	United States
Income per Capita	14 861 USD	25 547 USD	28 051 USD
Household Income	32 138 USD	60 749 USD	64 585 USD
Unemployment Rate	22.82%	12.46%	10.15%
Poverty level	38.12%	16.35%	14.88%
House value	59 700 USD	128 600 USD	181 400 USD
Vacancy rate	22.83%	14.56%	11.38%

Source: (World Media Group, LLC, 2014)

3.6 Detroit: Government

Detroit city is run by a mayor, the nine - member Detroit City Council, and clerk elected on a nonpartisan ballot. Detroit has a "strong mayoral" system, the mayor is approving departmental appointments. The council approves budgets, but the mayor is not obligated to adhere to any earmarking. The city clerk supervises elections and is formally charged with the maintenance of municipal records. City ordinances and

substantially large contracts must be approved by the council. Municipal elections for mayor, city council and city clerk are held in years following presidential elections. Last elections were held in 2013 (MILLER P Frederic and col., 2010).

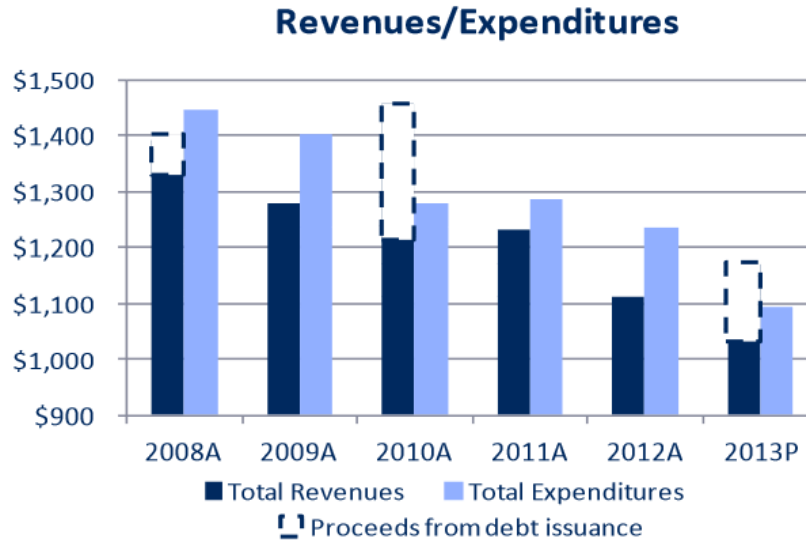
The City of Detroit's financial problems, based on over 250 million dollar budget deficit, are impacting its economic outlook. In April 2012 the city entered into financial stability agreement with the State of Michigan, allowing for limited state oversight in return for increased state aid, as a result of some major cuts were made in district budgetary levels. It has stemmed into pay cuts to the city's workforce, higher healthcare costs, reductions of retirements benefits for city workers. (DYE, 2012) Retired Detroit public servants have received letters notifying them that they lost their health insurance. The cuts and budgetary savings have caused a series of complains and effort to sue the city (PYKE, 2014).

In March 2013, the state took over the financial control of the city from the local government. The review team was created to look over the financial state of the city and determine if emergency manager is needed to take over control of city spending from city council. Later that month Kevyn Orr was named as emergency financial manager (The Associated Press, 2013).

3.6.1 City finances

The city of Detroit continues to incur expenditures in excess of revenues despite cost reductions and proceeds from long term debt issuances. In other words, Detroit spends more than it takes in – it is clearly insolvent on a cash flow basis. The graph below shows proportion of revenues to expenditures since 2008 to 2013.

Graph 3 - Revenues and expenditures of Detroit city

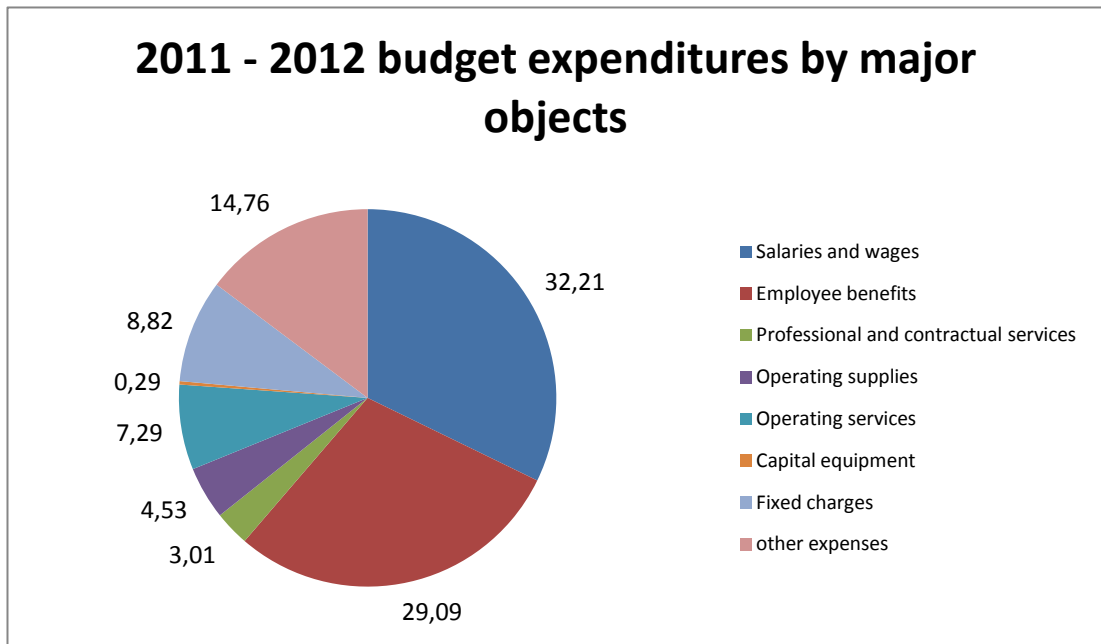


Source: (City of Detroit, 2013)

The city has attempted to solve these deficits by cutting costs in most areas of spending (headcount, maintenance and capital improvements, wages and benefits etc.) and by issuing increasing and alarming amounts of debt (Fiscal stability bonds). As written above, the drastic cost-cutting actions taken over the years have severely impacted most city service departments and deferred critical investment needed by the city. The cuts in expenditures resulted in decreased levels of core services such as public safety, recreation, transportation etc; obsolete in computer systems and related reporting systems; highly manual processes and inefficiencies in every day functions within city government; aging fleets of vehicles and equipment and lack of investment in infrastructure; and deferral of pension system contributions, which worsens the pension plans underfunded status (City of Detroit, 2013).

The graph below shows proportion of major expenditures in 2011 – 2012 budget of Detroit city. Largest part of expenditures is made by salaries and wages, and other employee benefits. Those two objects consist more than 60 % of total expenditures.

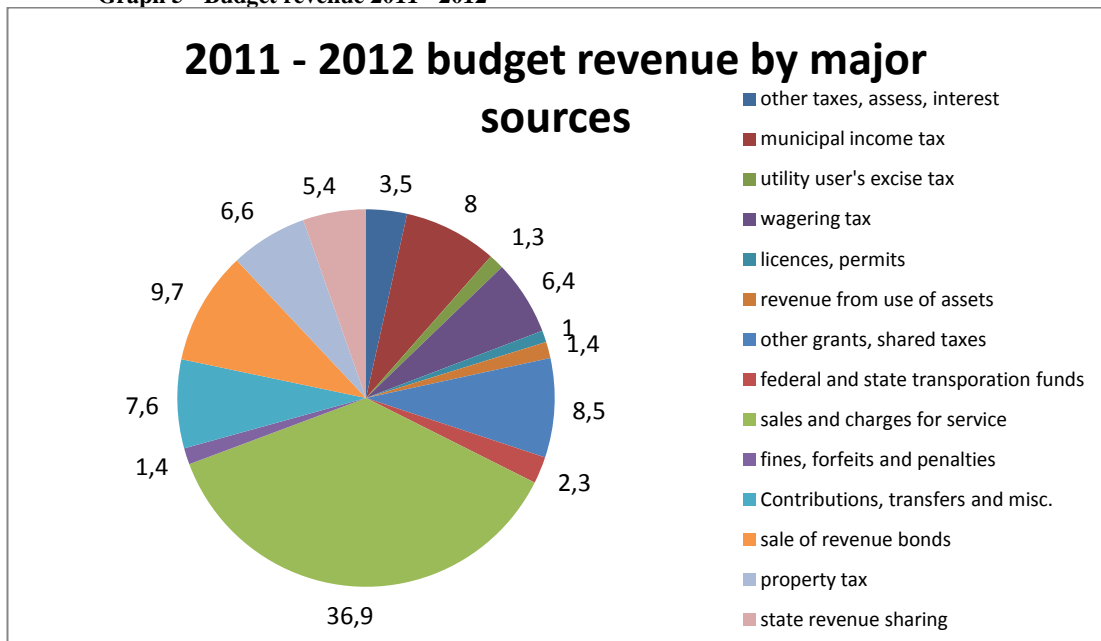
Graph 4 - Budget expenditures 2011 - 2012



Source: (City of Detroit, Budget Department, 2013)

The graph below shows proportion of major revenues in 2011 – 2012 budget of Detroit city. Largest part of revenues is made by sales and charges for service, almost by 37 percent.

Graph 5 - Budget revenue 2011 - 2012



Source: (City of Detroit, Budget Department, 2013)

3.7 Detroit: Health care

Medical treatment

Detroit is the primary medical treatment and referral center for southeastern Michigan. Vital factors in the health care industry are the education, training, and research programs conducted by the city's institutions of higher learning. The Wayne State University and University of Michigan schools of medicine, nursing, and pharmacy and allied health services provide area hospitals and clinics with medical professionals and support staff. The University of Detroit-Mercy offers programs in dentistry, nursing, and medical technology, and Madonna University provides a baccalaureate program in nursing.

The Detroit-area health care network is dominated by six health care providers. Those based in Detroit are the Detroit Medical Center and Henry Ford Health System. Henry Ford Hospital operates 32 centers and clinic. Among them are Center for Chemical Dependency and new Hermelin Brain Tumor Center, one of only a handful of such facilities in the country. The flagship 903-bed Henry Ford Hospital near Detroit's New Center is consistently ranked among the nation's best hospitals. The Henry Ford Health System is affiliated with the medical school of Case Western Reserve University of Cleveland. There are several others large hospitals in Detroit metro (Adavameg Inc., 2014).

The challenges facing the Detroit metropolitan area's health care system are intertwined with the challenges facing the community as a whole, including a declining and aging population; major suburban/urban differences in income, employment, health insurance coverage, and health status; and a shrinking industrial base. These realities affect all of the various components of the area's health care system, shaping the ongoing changes in the financing and delivery of medical care (TAYLOR, 2013).

The quality of health care in Detroit city remains good but lately due to financial cuts and restructuralization of health care system – the “right sizing”, which resulted into relocation and closure of some emergency medical centers, let alone that 27 of the city's 46 EMS vehicles are out of service today and the response times for an ambulance

to come vary from 12-30 minutes, compared to 8-10 minutes in surrounding countries (NEAVLING, 2011).

At the same time, as the Detroit area develops an overall strategy for economic renewal going forward, some envision the health care system as playing a major redevelopment role, to the point that “Medicine could possibly replace motors as the engine of Detroit.” City is contracting with private ambulance companies to handle the less urgent requests; Emergency Medical Services is one target of privatization plans. While this view may be overly optimistic, there is evidence of considerable vitality in Detroit’s traditionally strong health care system (PHAM, a další, 2010).

Fire department

Financial cuts hit the fire department hard, the city closed 15 stations – one quarter of the total – while 6-8 stations are on regular “brownout”. In 2006, the fire department had 1 700 people. By 2012 there was only 1 000 people to whom the city imposed a 10 percent pay cut. As a consequence of these cuts, firefighters are overworked and under-resourced, increasingly placing their own lives in jeopardy as a result. Detroit has one of the busiest fire departments in the country. By the city’s own admission, firefighters are fighting over 30,000 fires a year, with firefighter crews regularly fighting 3 to 5 fires a day (PORTER, 2013).

3.8 Detroit: Education

Elementary and Secondary Schools

Like many large urban school districts, Detroit has struggled heavily to maintain a quality level of education in the face of such problems as loss of population, budget shortfalls due to a dwindling local tax base and state-supplied resources, political infighting, and the enormous social implications of a largely impoverished city population. Low standardized test scores and graduation rates for students in the majority of schools were a sign of dysfunction across institutions. In the context of academic literature on the causes of poverty, Detroit students are held back by failures in both their schools and in their neighborhoods (Michigan Nonprofit Association., 2011).

By 2005 the district was able to report some positive gains in state-mandated test scores, as well as an ongoing school consolidation plan that sought to make the district more financially workable. A large number of state-mandated charter schools also provided some relief to the district, giving parents more options in placing children in smaller schools, many of which stress discipline, fundamental education in reading and mathematics, and even institute a dress code or school uniform policy. In addition, Rogers High School, Renaissance High, and Detroit Cass Technical High School consistently rank among the best schools in the state in the numbers of students that graduate and go on college (Adavameg Inc., 2014).

Colleges and Universities

There are 8 colleges and universities in Detroit metro. Worth of mentioning are Wayne State University, University of Detroit-Mercy and Center for Creative Studies in Detroit. Wayne State University is Detroit's largest institution of higher learning and Michigan's only urban research university. Students are enrolled in 12 schools and colleges, including the colleges of medicine, nursing, and pharmacy and allied health, and the law school (Adavameg Inc., 2014).

The second to mention is the University of Detroit-Mercy, a Roman Catholic institution run by the Jesuit order of priests, which offers bachelor, master and doctorate programs in the arts and sciences; the university also administers schools of law and dentistry. Approximately one-third of its students are minorities, and the university has been called one of the most diverse (Adavameg Inc., 2014).

The Center for Creative Studies in Detroit's Cultural Center is a private, four-year college that offers bachelor of fine arts degrees in animation and digital media, crafts, communication design, fine arts, industrial design, interior design, and photography (Adavameg Inc., 2014).

Libraries and Research Centers

Research centers affiliated with Wayne State University conduct activity in such fields as labor and urban affairs, ethnic studies, folklore, bioengineering, human growth and development, automotive research, manufacturing, and technology. At centers

affiliated with the University of Detroit-Mercy, research is conducted in aging and polymer technologies. The Budd Company, an engineering and manufacturing research center specializing in automotive design, recently opened four research and development centers in southeastern Michigan (Adavameg Inc., 2014).

The city's largest library is the Detroit Public Library, founded in 1865, is also the largest municipal library system in the state. Special collections include materials pertaining to national automotive history. The Wayne State University Libraries system ranks among the top 60 libraries in the Association for Research Libraries. It is comprised of a central facility with about 3 million volumes and five departmental libraries with separate holdings, including law and medical libraries (Adavameg Inc., 2014).

3.9 Detroit: Culture

Professional sports have a major fan following in Metro Detroit. The area is home to many sports teams, including six professional teams in four major sports. The city of Detroit has four professional sports teams: Detroit Red Wings, Detroit Lions, Detroit Tigers and Detroit Pistons. The Detroit Red Wings participates in the National Hockey League and they play in the Joe Louis Arena. The Detroit Lions participates in the National Football League and they play at Ford Field. The Detroit Tigers participates in Major League Baseball in the American League and they play at Comerica Park. Lastly, the Detroit Pistons participates in the National Basketball Association (Worldpopulationstatistics, 2013).

Michigan Stadium, home of the Michigan Wolverines, is the largest American football stadium in the world. Metro Detroit hosts many annual sporting events including auto and hydroplane racing. The area has hosted many major sporting events, including the 1994 FIFA World Cup, Super Bowl XVI, Super Bowl XL, the 2005 Major League Baseball All-Star Game, and the first two games of the 2006 World Series. (NEWTON, 2011).

Alongside to sporting events Detroit's three casinos have been an economic driver for the city, which gets about 15 percent of its general fund revenue from

gambling, or about \$177 million a year. But the rise in casino gambling in Ohio threatens Detroit's casino revenue (Forbes, 2014).

Well known is the Detroit Institute of Arts opened in 1927, with one of the most significant municipal art collections in the world. But some of its treasures could be sold, if the city goes into Chapter 9 bankruptcy. While a non-profit organization runs the museum and programs, the city owns the art works (Forbes, 2014).

Most affected by financial cuts were Detroit's parks. The city couldn't maintain parks in parts of city with low population. The cuts mean that only 57 of the city's more than 300 parks will be in operation this year. Those that remain open will see reduced staffing and maintenance. The park closures are part of the plans to deny services to so-called unviable neighborhoods, forcing residents to move out (JONES, 2013).

3.10 Detroit: Crime

Crime in Detroit, Michigan has decreased in many categories since the 1970s, but remains a serious issue, having the sixth highest total rate of violent crime and the highest per capita rate of violent crime in the United States in 2007. Crime is distributed unevenly across the city with the much of the violent crime emanating from selected neighborhoods in the upper east and central west. In 2008, the city unveiled a plan to revitalize these areas which include 7-Mile/Livernois, Brightmoor, East English Village, Grand River/Greenfield, North-End, and Osborn. A Michigan Metropolitan Information Center study has routinely shown crime in Downtown Detroit is much lower than national, state and metro averages. Although the rate of violent crime dropped by 11 percent in 2008, violent crime in Detroit has not declined as much as the national average from 2007 to 2011. It's because financial cuts in public services. In 2003 the Detroit Police Department went through reorganization, the department's thirteen precincts were consolidated into six larger districts: central, southwestern, northeastern, eastern, western, and northwestern. The reorganization has largely been hailed as a failure, with increased response times; higher call volumes, and less reliable patrol coverage. In 2011, it was announced that the Detroit Police Department will be reverting to the precinct structure as each of the then-existing districts will be split in two (Worldpopulationstatistics, 2013).

3.11 Detroit: Transportation

Detroit was built around the automobile; there is no commuter rail system and residents complain about the spottiness of its bus service. Currently, the Detroit city bus system does not operate beyond the city boundary and suburban buses operate with certain restrictions for Detroit riders. Within the city of Detroit 1/6 of households do not have access to a vehicle. Considering fact that the region's low-income and minority households are highly segregated, predominantly within the city of Detroit, and areas of job growth are located predominantly in suburban areas new reform of transit transportation is required. Current regional service systems lack informational (and sometimes physical) connections which makes transit more difficult to use for regional residents. The freeways are many and excellent in Detroit, as they must be in order to get commuters around the sprawling city. Six interstate highways and several limited-access expressways serve the Greater Detroit area. But the city lacks good public transport (Metropolitan Opportunity Unit, 2012).

3.12 Detroit: Institutions and active groups

Detroit faces incredibly challenging issues to include rising unemployment, crime, economic decline, and population loss consequently individuals and institutions across the city are becoming part of entrepreneurial, governmental and civic actions groups that are taking the initiative to revitalize Detroit. The leaders of these groups, however, often act in isolation, unaware of that their work has broader value. They are too busy to think about extending their work and join separate initiatives.

From larger civil institutions which are active in Detroit are: New Detroit, Kresge Foundation, Kellogg Foundation, Skillman Foundation, Data Driven Detroit, New Economy Initiative for Southeast Michigan, Project of Public Spaces, 15 x 15 initiatives; and many others.

New Detroit

New Detroit provides a forum for community leaders to come together to listen and learn from each other and to serve as a regional forum for sensitive issues among individuals who might otherwise have no contact. New Detroit has served as a catalyst

for change, influencing the actions of individuals and institutions. Economy and education are priority areas for New Detroit. Although New Detroit does not provide direct service for business development, it is directly involved in growing the capacity of small businesses and strengthening existing educational initiatives (New Detroit Inc., 2014).

Kresge Foundation

Is national foundation, founded in 1924, they provide continuous philanthropic support to the area's nonprofit organizations and community initiatives. In recent years the Kresge foundation took a proactive approach, engaging and collaborating with others seeking to renew the city. Areas in which foundation invest are education reform, support of small businesses, health, mass transit rail development, land use and Detroit arts and culture (The Kresge Foundation, 2014).

Skillman Foundation

The Skillman foundation was founded by Rose Skillman in 1960. The Foundation is organized to help create pathways for Detroit children to graduate from high school, and to be prepared for college, career, and life (The Skillman Foundation, 2014).

Data Driven Detroit

Data Driven Detroit (D3) is a statewide organization with a focus on the city of Detroit. The organization was founded in 2008 through a grant from the Skillman and Kresge Foundations. D3 manage a comprehensive data system that includes current and historic demographic, socioeconomic, educational, environmental and other indicators. D3 believes that direct and practical use of data which they offer will lead leaders and public officials to creation of effective policymaking and informed decision-making. Data Driven Detroit incorporates features of "neighborhood data systems" that have been created in a variety of cities across the country. In 2012, after an extensive period of review, discussion and due diligence, D3 became an affiliated program of the Michigan Nonprofit Association. This move has strengthened D3's operations and

increased its exposure to a statewide network of member nonprofits and philanthropic organizations (Michigan Nonprofit Association, 2013).

3.13 Statistical and econometric methods

In this chapter are explained statistical and econometrics methods used for own analysis.

3.13.1 Statistical methods

Frequency distribution

If we have a large data file, we can hardly draw any conclusions from raw numerical material. It is desired to sort obtained the data in some way (SVATOŠOVÁ, 2009). This classification is performed so that they would conduct the monitoring data quantitative values in increasing sequences and to each value is assigned a variant of respective statistical units which we called frequency. Formed table is called frequency distribution table. This table provides information of occurrence of each value in the file (HINDILS, Richard and col., 2007).

Frequency can be subdivided into:

Absolute frequency n_i , is the number of times that a certain value appears in a statistical study. Its sum is equal to the total number of data, which is denoted by n (SVATOŠOVÁ, 2009).

$$n_1 + n_2 + n_3 + \dots + n_k = \sum_{i=1}^k n_i = n \quad (4.1)$$

Relative frequency f_i , are used if we want to compare values which differ by its range (SVATOŠOVÁ, 2009).

$$f_i = \frac{n_i}{n}, f_1 + f_2 + f_3 + \dots + f_k = \sum_{i=1}^k f_i = 1 \quad (4.12)$$

In addition to the two types of the frequency distribution, we can also use the cumulative frequency distribution of both absolute – N_i , and relative – F_i , which provide information on how many units in a statistical data have the value less or equal to the value considered (HINDILS, Richard and col., 2007).

$$N_1 = n_1 \quad N_2 = n_1 + n_2 \quad N_k = n_1 + n_2 + n_3 + \dots + n_k = \sum_{i=1}^k n_i = n \quad (4.13)$$

$$F_1 = f_1 \quad F_2 = f_1 + f_2 \quad F_k = f_1 + f_2 + f_3 + \dots + f_k = \sum_{i=1}^k f_i = f \quad (4.14)$$

In case that we have continuous value or discrete value, which takes a large number of permutations, we use the interval of frequency distribution, in which the range of values is divided into a number of intervals and then we find the number of values belonging to these intervals (SVATOŠOVÁ, 2009).

In creation of the interval frequency distribution we are trying to suppress random fluctuations in frequency, but we cannot eliminate characteristics of the distribution (HINDILS, Richard and col., 2007).

Calculation of the average:

Absolute frequency

$$\bar{x} = \frac{\sum_{i=1}^k x_i * n_i}{n} \quad i = 1 \quad (4.15)$$

Relative frequency

$$\bar{X} = \sum_{i=1}^k x_i * f_i \quad (4.16)$$

Concept and types of time series

Determination of changes over time in a phenomenon is one of the most important statistical tasks. The time series is a basic mean of statistical analysis of collective phenomenon dynamics (SVATOŠOVÁ, Libuše, 2004). Time series is a sequence of substantively and spatially comparable data, which are organized in terms of time (HINDILS, Richard and col., 2007).

Time series can be defined from different perspectives. Depending on the nature of time series, we have discrete time series, which are recorded at certain moment in time usually a day. And continuous time series, which indicate how many things, events; were created, accumulated, consumed or destroyed during a certain time interval (SVATOŠOVÁ, Libuše, 2004).

According to the periodicity of the observed indicator, we have short-term time series (periodicity is less than one year) and long-term time series (periodicity is at least annual) (SVATOŠOVÁ, Libuše, 2004).

Depending on the type of observed values we can divide the time series to primary time series, or series of original values; and secondary time series, series of derived characteristics (HINDILS, Richard and col., 2007).

Elemental characteristics of time series

Usually, the first task in the analysis of time series is to get a quick picture of the characteristic of the process, which this series represents. One of the basis methods used for these purposes is the visual analysis, using graphs and indicators with identification of elementary statistical characteristics (HINDILS, Richard and col., 2007).

Using the visual analysis of graphic record during the time series, we can recognize a long-term tendency over time or some periodic changes, etc. This analysis is however not sufficient in terms of understanding the deeper connections and mechanisms of studied process. Elemental characteristics include differences, mean growth rates and average values of the time series (HINDILS, Richard and col., 2007).

The absolute characteristics or first differences, allow absolute comparison of values in time series. These differences characterize the absolute increase or decrease of the studied indicator in a specific moment (period) to specific moment (period) immediately preceding. The first absolute differences are in total $n-1$ (SVATOŠOVÁ, Libuše, 2004).

$$\Delta^1_t = y_t - y_{t-1}, t = 2, 3, \dots, n \quad (4.17)$$

Relative increases or second absolute differences characterize the absolute acceleration or deceleration of development in the studied time series. The relative increases indicate how much the next increment greater or smaller than the previous (SVATOŠOVÁ, Libuše, 2004).

$$\Delta^2_t = \Delta^1_t - \Delta^1_{t-1}, t = 3, 4, \dots, n \quad (4.18)$$

Besides the absolute characteristics are often used the relative characteristics of growth, respectively decline, which are dimensionless quantities. Growth rate characterize the relative rate of change in the time series (SVATOŠOVÁ, Libuše, 2004).

$$k_t = \frac{y_t}{y_{t-1}} \quad t = 2, 3, \dots, n \quad (4.19)$$

Growth rate can be determined for the whole time series, defined mostly as the geometric average of the individual coefficients for i . The average growth rate depends strongly on the extreme values in the time series. Thus it is possible to obtain exactly the same average growth rate for the series that are similar only in their extreme levels but otherwise completely different. Therefore it is necessary to analyze the time series and divide it into several parts, in which the studied indicator shows monotonic development and for them then determine the average growth rate (SVATOŠOVÁ, Libuše, 2004).

$$\bar{k} = \sqrt[n-1]{\frac{y_n}{y_1}} \quad (4.2)$$

The level of indicators in time series is most often characterized using the averages. The method of their calculation depends on the type of specific time series. If we are working with an interval we use arithmetic mean. If all intervals are of the same length, we use common arithmetic mean, if intervals are unequally long, it is necessary to calculate weighted arithmetic mean (SVATOŠOVÁ, Libuše, 2004).

3.13.2 Econometrics modeling

Econometrics is quantitative economics discipline dealing with measurement and empirical verification of real economic relationships and dependencies (TVRDOŇ, 2009).

Econometrics model

The econometric model represents a real phenomenon, explain it, forecast its behavior and enable its management. The econometric model is representation of realistically functioning economy, simplified but with regard on maintaining substantial

economic characteristics. In the first stage of formulation of an econometric model of an examined reality in which basic conception of branch are categories and magnitudes of the economic theory and branch economies. First of all an econometric model is described in words. If relations are quantifiable, the model is converted into a mathematical language (TVRDOŇ, 2009).

In the second stage disposable statistical data are collected which are sorted, aggregated and verified whether they have demanded statistical characters for an estimation of structural and stochastic parameters of a model. If original variables do not fulfill statistical demands, either a new formulation of equation and their variables will be necessary of original variables will be corrected with various procedures (TVRDOŇ, 2009).

The third stage represents own estimation of parameters of the econometric model. Many methods can be used to estimate these parameters; a choice of used methods depends on an aim of research, a frequency of ground data, relation among endogenous variables etc. To successful specification of econometric model it is necessary to correctly estimate the parameters, then verification of the model in the form of test criteria. That means verification if estimated parameters are consistent with base theoretical assumptions. If everything is correct it is possible to star with implementation of analysis (TVRDOŇ, 2009).

In final stage of the construction is the analysis and prognosis of researched phenomenon, including an evaluation of economic programs are done. It is necessary for econometric model to be specified exactly in line with base theoretical assumptions. If it is not, econometric model is losing its optimal characteristics and can be misinterpreted (TVRDOŇ, 2009).

The econometric model for purposes of this thesis will be at first presented in terms of adjusting the main variables (e.g. transformation of variables and exclusion of variables). Then it will follow estimation of parameters of the model and determination of statistical significant variables. Statistical significance will be marked by stars with following meaning: * = 0.1 (10 %), ** = 0.05 (5 %) and *** = 0.01 (1 %). More stars means higher level of significance. After estimation of parameters, the coefficient of

determination will be explained. For evaluation of the model will be used adjusted coefficient of determination. The coefficient eliminates problem with increasing value of R^2 based on number of variables. For the quality of the model is also important value of information criterion. Model will be evaluated by Schwarz and Akaike criterion.

In the evaluation process the assumptions, homoscedasticity, normality and multicollinearity will be tested, until the final model will be created. Testing of the assumptions will be done using p-value. Heteroscedasticity, which is not desired, will be tested by Breusch-Pagan test. For normality testing will be implemented χ^2 - goodness of fit test. Testing of multicollinearity will be done by method Variance Inflation Factor (VIF), this method is based on multiple coefficients of determination. At last the model will be tested by F-test and Ramsay RESET test. By this test we test hypothesis that endogenous variable is dependent on linear combination of explanatory variables.

3.13.3 Characteristics of variables used

Dependant variables

The dependant variable is the observed variable in an experiment or study whose changes are determined by the presence or degree of one or more explanatory variables. The dependent variable in this diploma thesis is total population, respectively population change over time with regard to socioeconomic factors which may influence it. Data were taken from several sources, majority of them were taken from American Community Survey for years 2000 to 2012. The base year was 2000 and it was compared with the interval from years 2008 to 2012. To avoid extremes that may occur in one year, thus misinterpretation of the final outcome.

Explanatory variables

There were a number of explanatory variables that were common to all cities studied. Not all explanatory variables were used in the final model. All explanatory variables are presented and discussed in next chapter

Median age – the base assumption is that population in a city with lower median age will more likely be growing, because a city with younger population is expected to have higher natality and immigration rate.

Vacant housing units – increases in vacant housing units would be expected to be a sign of unhealthy and unattractive city.

Owner occupied home value – rises in values of owner occupied units should have negative impact on immigration to the city, people would not be able to afford expensive houses, on the other hand high prices of houses means more lucrative place to live.

Mean travel time – higher travel time to work, school etc. in a city may be caused by high traffic, weak or non-existent public transport and poor infrastructure. All these factors are expected to have negative impact on quality of life in a city, thus they could lead to population decreases.

Residents' works in manufacturing – Detroit city was highly dependent on car's manufacturing; the globalization and automatization in developed countries had negative impact on employment in manufacturing. The base assumption is that cities with higher share of people working in manufacturing are more vulnerable to higher unemployment, lower residential values and crime.

Unemployment – if unemployment rises it indicates that there a poor economy in a city, which lack of new jobs offering. Higher unemployment would therefore mean population decrease.

Median household income – the base assumption is that the cities with higher median household income should have higher population growth; the household income is determined by income, pension and other social benefits.

Income per capita – also known as income per person, it is calculated by taking a measure of all sources of income in the aggregate (such as GDP) and dividing in by the total population. Higher income should have positive impact on population growth.

Residents below poverty – poverty is a state or a condition in which a person lacks the financial resources and essentials to enjoy a minimum standard of life and well-being that is considered acceptable in society. A high poverty rate often indicates larger scale issues within the city; therefore it would have negative impact on population increase (Investopedia US, A Division of IAC, 2014).

Monthly owner cost for housing – this indicator combines price of energy, rent, mortgage and income. Lower costs for housing are premise for population increase.

Educated population index – higher education index simply means more educated population in a city. More educated population usually means innovation, development, research progress and more skilled labor. All these factors have positive impact on population growth.

Crime index – cities or regions with higher criminality tends to force people away from these areas. The cities with higher criminality should expect population loss.

New construction permits – construction permits are sign of development in a city. If there is high increase in construction, we can assume that there will be an increase of population.

Local purchasing power – shows relative purchasing power in buying goods and services in a given city for the average wage in that city. The cities with higher purchasing power should be more attractive.

Cost of living – is the cost of maintaining a certain standard of living. The cost of living index includes money spent on rent, transportation, food and restaurants etc. The prices are relative to national average. This means that if a city has index of 120 it is 20% more expensive than national average. The lower index is more desirable the city is.

Culture, Restaurant and Education indexes – these indexes can be interpreted as availability and quality of educational etc. services. The index score is relative to national average. The national average has score of 100; a score of 200 indicates twice

the national average, while 50 indicates half the national average. Cities with higher indexes should be more sought by potential residents.

Medical index – Higher index is better the quality of medical services in a city is, therefore people will settle near areas with good medical services. The medical index includes skill and competency of medical staff, responsiveness in medical institutions, equipment and location.

Consumer price index – is a relative indicator of consumer goods price, including groceries, restaurants, transportation and utilities. Consumer price index does not include accommodation expenses such as rent or mortgage. This means that if a city has index of 120 it is 20% more expensive than national average. The lower index is more desirable the city is (Numbeo, 2014).

Pollution index – is an estimation of the overall pollution in the city. The biggest weight is given to two main pollution factors; to air pollution and to water pollution and accessibility. Small weight is given to other pollution types. The lower index is more desirable the city is (Numbeo, 2014).

Price to income ratio – is the basic measure for apartment purchase affordability. It is the ratio of median apartment prices to median familial disposable income, expressed as years of income. The lower ratio is more likely will be residents in the area prone to migrate and buy houses (Numbeo, 2014).

Mortgage as percentage of income - is the ratio of the actual monthly cost of the mortgage to take-home family income. Average monthly salary is used to estimate family income. Families with lower median income should be more affected by this; the assumption is that the lower ratio will have positive impact on migration to the city (Numbeo, 2014).

Quality of life – is an estimation of overall quality of life by using empirical formula. The formula includes and put highest weight to pollution and safety, following by traffic, health care, income and rent. The quality of life index includes several indexes mentioned above. The higher index is the greater should be increase of population in a city (Numbeo, 2014).

3.13.4 Methods for verification of the model

There are explained a number of potential statistical problems that can undermine the validity of the econometric analysis.

Multicollinearity

Multicollinearity suggests that several of the independent variables are closely linked in some way. Colinearity between endogenous and exogenous variable is not multicollinearity. Once the collinear variables are identified, it may be helpful to study whether there is a causal link between the variables (Investopedia US, A Division of IAC, 2014).

The multicollinearity problems can be ignored and the model is adequate if multicollinearity will not affect characteristic of the OLS model. Therefore if multicollinearity will not reduce t-ratios it can be ignored (CIPRA, 2008).

The multicollinearity problems can be resolved by excluding one or more explanatory variables which are causing multicollinearity until there is only one remaining out of the set. This procedure can disturb interpretation of the model. Alternatively it is possible to transform some explanatory variables. Different modifications of explanatory variables (e.g. centering by subtracting the sample mean; standardization of centered variables to unit standard deviation; differentiation and by replacing highly correlated regressors by their ratio etc.) could reduce multicollinearity. If possible multicollinearity could be reduced by extension of gathered data. Lastly the most objective way how to resolve multicollinearity is by using method of major component (CIPRA, 2008).

Normality

The model is normal if residuals are normally distributed for all t (it means that moments values of this distribution, thus zero median value and constant variance, were determined in previous assumptions. Normality is necessary for situations, where is needed to specify probability of residuals distribution, so we could statistically test different hypothesis in the model, create reliability and predictive intervals and find the

maximum likelihood parameter estimates. Normality can be statistically tested (eg. by Jarque-Bera test) (CIPRA, 2008).

Coefficient of determination

After estimation of the model, it is necessary to evaluate, if the model is compatible with data used. Coefficient of determination (R^2) is often used to define level of adequacy of the model. R^2 is the selective version of square correlation coefficient between y and \hat{y} . If this square correlation is high (near one) then model fits to selected data. If on the other hand is square correlation low (near zero) the model is not suitable for selected data. Maximalization of coefficient R^2 is equivalent to criterion of least squares (CIPRA, 2008).

The coefficient of determination is defined as:

$$R^2 = \frac{ESS}{TSS} = 1 - \frac{RSS}{TSS} \quad (4.21)$$

Where:

$$RSS = \sum_{t=1}^T \hat{\varepsilon}_t^2 = \sum_{t=1}^T (y_t - \hat{y}_t)^2 \quad (4.22)$$

$$ESS = \sum_{t=1}^T (\hat{y}_t - \bar{y})^2 \quad (4.23)$$

$$TSS = ESS + RSS \quad (4.24)$$

Heteroscedasticity

Heteroscedasticity occurs when the variance of the error terms differ across observations. Heteroscedasticity occurs most often with cross-sectional data. Heteroscedasticity cause standard errors of the estimates biased (CIPRA, 2008).

4 Analysis of Detroit Metro

4.1 Determination of key factors - Econometric model

This chapter will deal with the final econometric model with endogenous variable Net population change. In the text of the work are used some outputs from Gretl, other outputs are in annexes.

4.1.1 The first model

Correlation matrix in the model

The problem of multicollinearity can occur if correlation in absolute value between two exogenous variables is higher than 0.9. In annexes VII and VIII are highlighted in red statistically significant correlations (on significance level of 0.05).

In the process of creation of the model highest correlation (0.98) was found between variables Mortgage as percentage of income and Price to income ratio. Correlation is positive (and statistically significant) thus is obvious that both variables are highly influenced by income and mortgage. And it is necessary to eliminate one of the variables because they are almost identical. Variable Mortgage as percentage of income had high correlation also with Purchasing power index (0.84) and Owner occupied value of housing units (0.82). Mortgage as percentage of income was excluded from the model to avoid distortion of the result.

Also the variable Owner occupied value of housing units had high correlation (0.98) with Cost of living. This variable had also high correlations Income per capita (0.81), Median household income (0.82) and Price to income ratio (0.82). Correlations are positive (and statistically significant) thus is obvious that variables are linked by income and have very similar development. Owner occupied value of housing units and Income per capita were excluded from the model.

The median household income and price to income ratio include necessary characteristics from excluded variables, thus the model still represent reality and have enough data for unbiased estimation.

Estimated model

The first model includes all variables to test the assumptions and the validity of the model. Variables were excluded based on sequence elimination for p-value > than 0.2. P-values for these variables are shown in sequence elimination table below.

Table 2 - Sequence elimination table in first model

Cost of living	0.87	Consumer price index	0.57
Mean travel time	0.60	Education people index	0.43
Earthquake index	0.49	Level below poverty	0.59
Manufacturing	0.31	Median age	0.28
Restaurant index	0.27	Culture index	0.30

Source: own work

The estimated model has 13 explanatory variables. All explanatory variables have significant effect on population change in a city. The Medical and Education indexes were kept in the model even though they are over 0.05 level of statistical significance. These variables are necessary for the model, when those variables were excluded the model lost on its estimation quality. Fourteen explanatory variables were excluded from the model in the process from the total of 27 variables.

Table 3 - First model part I.

	Coefficient	Std. deviation	t-ratio	p-value	
Const	34.2748	18.6669	1.8361	0.07698	*
Vacant_housing	-1.83089	0.212128	-8.6311	<0.00001	***
Unemployment	0.720454	0.331501	2.1733	0.03837	**
Household_income	-0.220758	0.098913	-2.2318	0.03381	**
M_owner_cost	-1.10848	0.343196	-3.2299	0.00316	***
Crime_index	0.0105214	0.00599628	1.7546	0.09026	*
New_construction	1.70372	0.142691	11.9399	<0.00001	***
Purchasing_power	-0.115577	0.0563579	-2.0508	0.04976	**
Quality_of_life	0.123911	0.0445781	2.7796	0.00961	***
Medical_index	-0.0961996	0.0713117	-1.3490	0.18815	
Education_index	-0.126961	0.0934981	-1.3579	0.18534	
Pollution_index	0.166441	0.0672147	2.4763	0.01959	**
Price_to_income_r	1.84138	0.634064	2.9041	0.00711	***
Climate_index	-0.0440311	0.0179379	-2.4546	0.02058	**

*Source: own work***Table 4 - First model part II.**

Mean dependent var.	5.286696		S. D. dependent var.	13.45527
Sum squared resid	397.5846		S. E. of regression	3.768216
Coefficient of determination	0.946437		Adjusted coefficient of determination	0.921569
F(13,28)	38.05798		P-value(F)	2.60e-14
Log-likelihood	-106.7979		Akaike criterion	241.5958
Schwarz criterion	265.9232		Hannan-Quinn criterion	250.5128

Source: own work

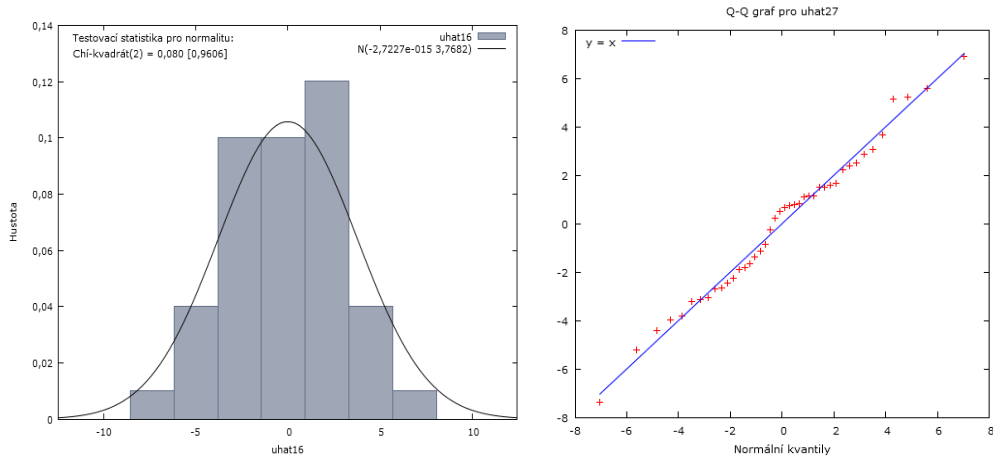
Adjusted coefficient of determination is 0.946437; it means that in the model is explained 94 % of data variability. There is no heteroscedasticity in the model (White p-value 0.55 and Breusch-Pagan test 0.52). Test of normality of residuals do not rejects normally distributed residuals (p-value 0.96). There is no multicollinearity in the model (see the table below). Also linearity of the model was not rejected (p-value 0.004).

Table 5 - Multicollinearity in the first model

Vacant_housing	2.857	Quality_of_life	4.203
Unemployment	4.062	Culture_Index	7.215
Household_income	3.754	Medical_index	1.521
M_owner_cost	3.216	Education_index	2.006
Crime_index	2.601	Pollution_index	3.887
New_construction	2.7	Price_to_income_r.	3.281
Purchasing_power	2.005		

Source: own work

Graph 6 - Set of graphs in the first model; left graph: histogram, normality of residuals; right graph Q-Q graph of residuals



Source: own work

Model meets all requirements, yet it is still necessary to be accurately specified. For estimation of specification of the model we can use F-test and RESET test. Implementation in Gretl allows us to test by RESET test three specifications: second and third squares or both. All variant of the test don't reject H_0 , thus we can say that the model is linear. Model fulfils all requirements and therefore can be used for analysis of population growth in cities. Q-Q graph of residuals shows, that data are very close to estimated line, thus model explains course of data.

Interpretation of the model

The variables in the model have different level of significance. As the least significant variable can be interpreted Medical index (p-value 0.19). Another variable

with low significance was education index (p-value 0.18). Nevertheless exclusion of these variables will not improve the model, but exactly opposite. Surprising is exclusion of variables Mean travel time, Cost of living and Consumer price index. Differences in mean travel time in US cities were so indistinct that we reject H_0 hypothesis about importance of commuting. Cost of living and Consumer price index have low impact on how people perceive the attractiveness of the city, their H_0 hypothesis were also rejected.

The size of the constant tells us the base population growth over a decade in 42 biggest cities in United States. The constant is a positive number 34.27. Net population growth varied across cities. The lowest value was -29.06 percent in New Orleans followed by -24.9 percent in Detroit. The highest value was in Forth worth (38.6) and in Charlotte (35.24). The average net population increase over a decade (2000-2010) in selected cities was 7.53 percent. The average for whole United States was 9.71. The average net population increase for selected cities calculated from estimated model is 8.16. Thus we can say that the output of the model is close to reality, but some parameters of exogenous variances are misleading. We will discuss it below for relevant parameters.

Variable Vacant Housing Units and New Construction were statistically most significant factors which determined net population change. When share percent of vacant housing units increases in a city by one unit we can expect that net population will decrease by 1.83. Thus we can accept H_0 hypothesis, that vacant houses are source of negative causes (squatters, crime, depreciation of property value etc.) of population decline. New construction has also high impact on population change. When share of new buildings built in last decade rises about one unit, the population of the city will increase about 1.7 percent. Therefore we can accept H_0 hypothesis that new construction brings to the city new opportunities, jobs, attract firms and investment. All these factors have positive impact on population growth.

Detroit city had second highest share of vacant housing units (22.84 in 2010) from the data set. Only New Orleans had more vacant houses (25.14). The average vacancy rate for selected cities was 11.25 percent of total houses and the average for

United States is 11.38. If we compare the vacancy rate with net population growth we see that the two cities with largest population decline were also New Orleans and Detroit city, also in other cases high vacancy rate was directly linked with population decrease. The explanation in those cases is simple, people move away, leaving empty houses behind. Similar trend has been detected in variable New Construction. Detroit city had lowest construction rate in last decade (1.69 percent of total buildings in Detroit city was built in 2000 to 2010). The calculated average from the data sample was 11.97. New buildings are not built in Detroit city because Detroit has already surplus of empty, vacant buildings. To create space for new construction old vacant buildings with no use have to be reconstructed or demolished.

There are two more factors with statistical significance over 95%, Monthly Owner Costs and Quality of Life. When the share of monthly owner costs increases by one unit in a city, the population of city will decrease by 1.1 percent. We can accept H_0 hypothesis, if residents are going to pay more for housing they will more likely move to another location. Quality of Life has positive impact on population change. When quality of life index increases by one unit, then population in a city will increase by 0.12 percent. We can accept H_0 hypothesis, that quality of life is one of key factors which determine total population in an area.

All variables mentioned above were with accordance with reality expectations. But if we look at variables with less statistical significance, the expectations for real model cease to be valid. Let's look at some examples.

When unemployment increases by one unit, the population of the city will increase. We must reject the H_0 hypothesis that areas with high unemployment are not sought by potential residents even though they will more likely not find jobs in these areas. Another variable is Median Household Income. When median household income increases by one unit, the population of a city will decrease by 0.2. In other words, each increase by 1 000 dollars in household income will lead to population decrease by 0.2 percent. H_0 hypothesis is rejected and reality check failed. We can mention also Purchasing Power Index. Cities where people can buy more goods and services, because these services are cheaper or they have higher income, will more likely be cities who

suffer with population loss. The errors of the estimations continue across all parameters with lower statistical significance.

Although the model met all requirements and passed all verification tests we cannot say it represent the reality. In attempt to create more accurate model the inaccurate variables (Unemployment, Household Income, Crime Index, Purchasing Power, Medical Index, Education Index, Pollution Index, Price to Income Ratio and Climate Index) were excluded. The reduction damaged the model previously significant variables were no longer significant. The coefficient of determination dropped rapidly, the number of standard errors increased and Akaike coefficient show higher values. The model was not sufficient for purposes of the research thus new model had to be estimated.

The table below explains how much variables Vacant Housing Units and New Construction explain the model.

Table 6 - Significance of selected variables in the first model

	Coefficient	Std. deviation	t-ratio	p-value	
const	6.0906	2.59279	-2.349	0.024	**
Vacant_housing	-1.46665	0.158238	-9.269	2.10e-011	***
New_construction	1.3228	0.10949	12.08	9.45e-015	***

Source: own work

The adjusted coefficient of determination was 0.88. This means that net population growth was explained by 88 % just by those two variables. The model was verified and was found to be applicable.

4.1.2 Reduced model

The second model is reduced model. At first the variables with high multicollinearity were excluded and then variables with highest statistical significance (Vacant Housing Units and New Construction) were excluded. The assumption was that the model was too dependent on them, that it was not able to describe correctly influence of other variables. The second model had at first 16 variables. Variables were

excluded based on sequence elimination for p-value > than 0.2. P-values for these variables are shown in sequence elimination table below.

Table 7 - Sequence elimination table in reduced model

Monthly owner costs	0.76	Crime index	0.54
Culture index	0.68	Pollution index	0.50
Medical index	0.51	Purchasing power	0.38
Price to income ratio	0.58	Consumer price index	0.24
Restaurant index	0.63	Education index	0.23

Source: own work

The estimated model has 7 explanatory variables. All explanatory variables have significant effect on population change in a city. The Earthquake/Tornado index was kept in the model even though it has p-value 0.21. These variable is necessary for the model, when the variable was excluded the model lost on its estimation quality. 20 explanatory variables were excluded from the model in the process from the total of 27 variables.

Table 8 - Reduced model; part I

	Coefficient	Std. deviation	t-ratio	p-value	
const	-33.1792	19.4929	-1.7021	0.09786	*
Mean_travel_time	0.804303	0.449878	1.7878	0.08272	*
Unemployment	-0.995554	0.561338	-1.7735	0.08510	*
Household_inc.	0.794802	0.278112	2.8579	0.00723	***
Cost_of_living	-0.308914	0.101284	-3.0500	0.00441	***
Quality_of_life	0.111978	0.0596718	1.8766	0.06918	*
Earthquake_index	-0.0182709	0.014388	-1.2699	0.21275	
Climiate_index	0.068208	0.0323937	2.1056	0.04270	**

Source: own work

Table 9 - Reduced model; part II

Mean dependent var.	5.286696		S. D. dependent var.	13.45527
Sum squared resid	2904.625		S. E. of regression	9.242842
Coefficient of determination	0.60869		Adjusted coefficient of determination	0.528126
F(7,34)	7.555365		P-value(F)	0.000017
Log-likelihood	-148.5596		Akaike criterion	313.1192
Schwarz criterion	327.0206		Hannan-Quinn criterion	318.2146

Source: own work

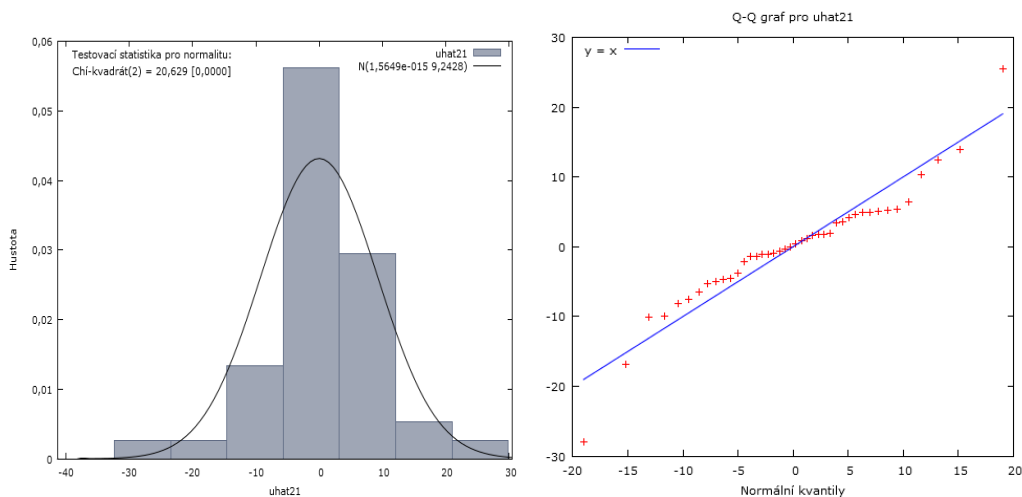
Coefficient of determination is 0.60869; it means that in the model is explained 61 % of data variability. The coefficient of determination is much lower than in previous model; it is caused by smaller data sample and lack of two variables which explained the model by 89% by themselves at the determinant of other variables. There is no heteroscedasticity in the model (White p-value 0.94 and Breusch-Pagan test 0.18). Test of normality of residuals do not reject normally distributed residuals (p-value 0.331525 e-005). There is no multicollinearity in the model (see the table below). Also linearity of the model was not rejected (p-value 0.33).

Table 10 - Multicollinearity in reduced model

Mean_travel_time	1.882	Quality_of_life	1.252
Unemployment	1.936	Earthquake_index	1.533
Household_income	4.933	Climate_index	1.743
Cost_of_living	4.119		

Source: own work

Graph 7 - Set of graphs in the reduced model; left graph: histogram, normality of residuals; right graph Q-Q graph of residuals



Source: own work

Model meets all requirements, yet it is still necessary to be accurately specified. For estimation of specification of the model we can use F-test and RESET test. Implementation in Gretl allows us to test by RESET test three specifications: second and third squares or both. All variant of the test don't reject H_0 , thus we can say that the model is linear. Model fulfils all requirements and therefore can be used for analysis of population growth in cities. Q-Q graph of residuals shows, that data are very close to estimated line, thus model explains course of data.

Interpretation of the model

The reduced model serves for purposes of determination other significant variables than Vacant Houses and New Construction. The variables in the model have different level of significance. As the least significant variable can be interpreted Earthquake/Tornado index (p-value 0.21). Nevertheless exclusion of these variables will not improve the model, but exactly opposite. During the process of formulation of the model, several variables were excluded due to their low statistical significance. Some of them were excluded in the first model as well. Monthly Owner Costs and Price to Income Ratio are worth of mentioning, because they were statistically significant in previous model at level p-value < 0.05 . Both variables have in common level of income and cost for housing (rent, energy and mortgage). The Median Household Income was

statistically significant thus we can say that cost for housing have low impact on population change. Several indexes (Culture, Medical, Crime, Restaurant, Pollution and Education indexes) were excluded from the model. Those indexes showed the accessibility and quality of education, restaurant and medical services or scope of crime and pollution in selected city. None of these indexes except the Education Index had p-value lower than 0.5. This might be caused by low differentiation between variables in the data sample (all cities had similar level of these indexes). Thus higher statistical significance would appear if we compare metropolis and cities or cities and villages.

The size of the constant tells us the base population growth over a decade in 42 biggest cities in United States. The constant is a negative number -33.17. The average net population increase over a decade (2000-2010) in selected cities was 7.53 percent. The average net population increase for selected cities calculated from estimated model is 7.66. This is closer to reality than in previous model (8.16) even the parameters estimation passed the reality check.

Mean travel time became statistically significant in this model (p-value 0.082). Each extra minute on the way to work means 0.8 increase in net population. After detailed analysis of variable it was found that major cause for high travel time was not bad infrastructure of the city or lack of public transport but high traffic. Therefore we can reject H_0 hypothesis, that cities with higher traffic are not sought by potential residents but that higher traffic is a sign of populated and active city with some exceptions.

Unemployment reflects negatively on net population. For every one percent unit increase in unemployment net population will decrease by the same amount. We can say that people tend to avoid areas with high unemployment.

Mean travel time and unemployment in relation with Detroit metro will be explained in the next model.

Quality of life remained important factor for estimation of net population change, but with lower level of significance (p-value 0.6). Quality of life has positive impact on total population. If the Quality of life index increases by one unit the

population will increase by 0.11 percent. For calculation of Quality of life index is used empirical formula. The formula includes and put highest weight to pollution and safety, following by traffic, health care, income and rent.

Climate index had the third highest level of significance and had positive impact on total population. The cities located in areas with better climatic conditions are more sought by potential residents (e.g. Florida). Unfortunately weather cannot be changed so some areas will always be more sought than others.

Earthquake/Tornado index was the least significant variable in the reduced model. Often occurrence of natural disasters (earthquakes, hurricanes or tornadoes) force people to move away from affected area. The earthquake/tornado index has lower impact on total population than climate index. Explanation is following. People are willing to suffer from natural disaster from time to time, if they can enjoy nice weather and warm climate over the rest of the year.

Detroit city is located in Michigan, Midwestern state of the United States. The climate is unfavorable for this location; climate index was the third lowest. The Earthquake/Tornado index was somewhere around the median in the data sample. Thus even though Detroit city is less likely to be struck by a tornado or earthquake, the climate index have higher significance when people chose the region want to live in.

Cost of living was the most significant determinant for the reduced model. Cost of living is the cost of maintaining a certain standard of living. The cost of living index includes money spent on rent, transportation, food and restaurants etc. in comparison with US average. If the cost of living index increases by one unit (prices of food, restaurants etc. increase) it will cause population decrease by 0.3 percent. In case of Detroit metro the cost of living is very low, in fact the fourth lowest in data set. The cost of living index was 79. It means that Detroit city is by 21 percent less expensive than national average. According to the index the Detroit city should be favorite destination of immigrants due to its low costs for living, but the index does not include low income in the city, so even if the prices of goods and services are low, they are for local residents as expensive as they would be in other cities with higher Cost of living index.

Median household income was the second most significant variable in the reduced model. When median household income increases by one unit, the population of a city will increase by 0.79 percent. In other words, each increase by 1 000 dollars in household income will lead to population increase by 0.79 percent. The reduced model estimates better the reality than first model where increase in median household income led to population decrease. Relationship between household income and population decline will be explained in following model.

In summary, people come in a city looking for financial security ensured by employment, income, prices of goods and services, retirement and financial safety in case they will not be able to work anymore. The second factor is location of the city with regard to climate and potential disasters.

We should not forget statistically significant variables from the first model, but the vacant houses and new construction are more likely to be consequences of other factors than their causes.

4.1.3 Auxiliary models

The first two econometric models determined the financial security as the root cause of population growth in a city. The auxiliary models will be used for estimation of key parameters of household income and unemployment based on gathered data. These models should give us clear answer on questions what are the causes of depopulation and how they can be resolved.

Household income model

The estimated model has 7 explanatory variables. All explanatory variables have significant effect on change of household income.

The household income model is reduced model. At first the variables with high multicollinearity were excluded and then variables which did not explain the model.

Table 11 - Median household income model; part I.

	Coefficient	Std. deviation	t-ratio	p-value	
const	-118.172	30.7973	-3.8371	0.00052	***
Mean_travel_time	0.824386	0.241374	3.4154	0.00167	***
Educated_p_index	7.61544	1.88878	4.0319	0.00030	***
Crime_index	-0.019271	0.00836479	-2.3039	0.02747	**
Median_age	1.36902	0.583206	2.3474	0.02487	**
Unemployment	-0.756623	0.439798	-1.7204	0.09445	*
Manufacturing	1.12489	0.314581	3.5758	0.00107	***
New_construction	0.281803	0.161566	1.7442	0.09016	*

Source: own work

Table 12 - Median household income model; part II.

Mean dependent var.	46.13757		S. D. dependent var.	11.52766
Sum squared resid.	1227.946		S. E. of regression	6.009663
Coefficient of determination	0.774621		Adjusted coefficient of determination	0.72822
F(7,34)	16.69387		P-value(F)	2,51e-09
Log-likelihood	-130.4794		Akaike criterion	276.9588
Schwarz criterion	290.8602		Hannan-Quinn criterion	282.0542

Source: own work

The adjusted coefficient of determination is 0.728; it means that in the model is explained 73 percent of data variability. There is no heteroscedasticity in the model (White p-value 0.225 and Breusch-Pagan test 0.25). Test of normality of residuals do not rejects normally distributed residuals (p-value 0.348). There is no multicollinearity in the model. Also linearity of the model was not rejected (p-value 0.0028). All variants of RESET test don't reject H_0 , thus we can say that the model is linear.

Estimated model revealed new relations between variables. **Educated People Index** had highest impact on income. The higher the index, the more educated population is in selected city. If Educated People Index rises by one unit, the median household income will rise by 7 600 dollars. Detroit city has the third lowest Educated People Index from all 42 cities in data sample. The index for Detroit city is 12.37 and

the US average is 13.47. The model suggest that Detroit should have lower income then the rest of the United States and if it is compared to the data sample Detroit city has the second lowest median household income (26 955 dollars). The median household income for United States is 53 046 dollars.

The Crime Index has highest negative impact on median household income. Detroit city has highest crime rate from the data sample. Thus the relationship is probably based on fact that areas with high crime rate force middle class to move to suburbs or another city or country, leaving low income class in the center.

Mean Travel Time should have according to estimated model positive impact on median household income. This is done by larger cities in the sample where high mean travel time means high traffic and large population. Those cities have also higher income. In case of Detroit city, mean travel time to work is the tenth highest (26.4 minutes) but the income remains one of the lowest. It can be explained by insufficient public transport (lack of commuter rail system and car accessibility for residents) and poor infrastructure of the city (caused by depopulation - abandoned areas).

Unemployment model

The estimated model has 5 explanatory variables. All explanatory variables have significant effect on change unemployment.

The unemployment model is reduced model. At first the variables with high multicollinearity were excluded and then variables which did not explain the model.

Table 13 - Unemployment model; part I

	Coefficient	Std. deviation	t-ratio	p-value	
const	19.2814	10.6232	1.8150	0.07786	*
Mean_travel_time	0.133043	0.0868579	1.5317	0.13433	
Educated_p_index	-2.35403	0.587075	-4.0098	0.00029	***
Crime_index	0.00998686	0.00270416	3.6931	0.00073	***
Median_age	0.478312	0.206372	2.3177	0.02626	**
New_construction	-0.0725617	0.0593735	-1.2221	0.22960	

Source: own work

Table 14 - Unemployment model; part II

Mean dependent var.	10.92595		S. D. dependent var.	3.577686
Sum squared resid.	187.8352		S. E. of regression	2.284216
Coefficient of determination	0.642078		Adjusted coefficient of determination	0.592367
F(7,34)	12.91611		P-value(F)	3.17-07
Log-likelihood	-91.05122		Akaike criterion	194.1024
Schwarz criterion	204.5284		Hannan-Quinn criterion	197.9240

Source: own work

The coefficient of determination is 0.642; it means that in the model is explained 64 percent of data variability. There is no heteroscedasticity in the model (White p-value 0.18 and Breusch-Pagan test 0.15). Test of normality of residuals do not rejects normally distributed residuals (p-value 1.944). There is no multicollinearity in the model. Also linearity of the model was not rejected (p-value 0.0085). All variants of RESET test don't reject H_0 , thus we can say that the model is linear.

Estimated model revealed similar relations between variables as was found in median household model. **Educated People Index** had highest negative impact on unemployment. If Educated People Index rises by one unit, the unemployment will decrease by 2.3 percent. Detroit city has the second lowest educated people index. The model suggest that Detroit should have higher unemployment then the rest of the United States and if it is compared to the data sample Detroit city had the highest unemployment (22.8 percent in 2010; the US average was 9.19 percent in 2010). We can say that in Detroit city are no jobs offering for unskilled labor.

The Crime Index plays again important part in the estimated model and has significant positive impact on unemployment. Detroit city has highest crime rate and also highest unemployment rate. Thus the relationship is might be also based on fact that areas with high crime rate force middle class to move to suburbs or another city or country, leaving low income, uneducated, class in the center where they cannot find employment.

Poverty Level and **Medical Index** were determined by econometric model as the main causes of crime in selected cities. Detroit city has highest poverty level (almost 38 percent of population is living in poverty); the average poverty level for United States is 14.8 percent. And Detroit city was ranked eleventh worst in quality of medical services.

Mean Travel Time has positive impact on unemployment. The statistical significance of the parameter in this model was not as high as in previous model and has low impact on other cities in the sample but in case of Detroit city it is an important factor.

The auxiliary models identified five variables as causes of financial insecurity. Thus causes of depopulation in selected cities, especially Detroit metro.

4.2 Socio-economic analysis of Detroit Metro

A review of demographic and economic trends in the Detroit city based on literature review, econometric model and statistical data from various sources reveals the following key findings:

Population decline

Population decline was largely concentrated in the center of Detroit city, posing critical challenges particularly to low-income communities. Population loss present challenge for economic regeneration. The number of young people in the metro is shrinking; average median age rose by 4 years since 2000. Median age in Detroit city in 2010 was 34.8 years. The median age in United States rose by 2 years since 2000 and median age in selected cities rose by 0.68 since 2000. The Detroit city suffered largest out migration of young people and still struggles to attract young professionals to the city. This phenomenon is called “brain drain”. This phenomenon is often used for countries, especially in context with developing countries. In case of Detroit the brain drain cost the city valuable professionals who seek opportunities elsewhere. These professionals often earn large salaries, so their departure removes significant consumer spending from the city.

While the white and black populations continue to decline, foreign born population increased over the past decade. Especially Asian and Hispanic population are yet small but growing part of the metro. Those minorities rose by 2 percent since 2000.

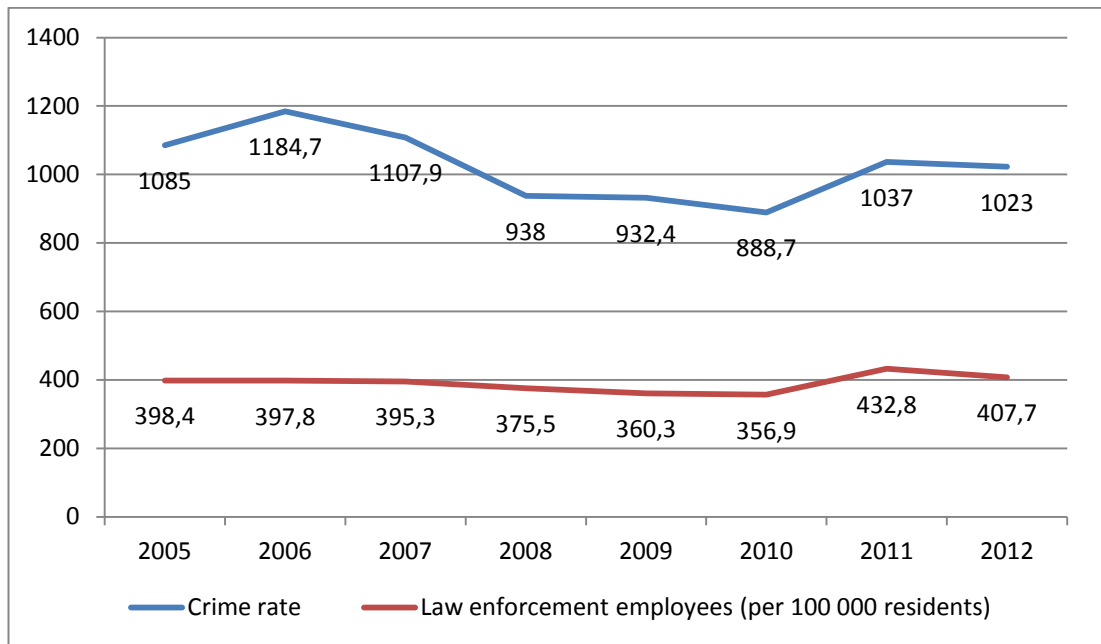
Proposals: Depopulation of Detroit city can be slowed by increasing civic engagement and awareness. In 2012 civic engagement team’s efforts had reached over 35 000 people in the city through conversations, interactions and written feedback to the city. Those civil organizations work often in isolation, unaware of work of others. Thus a clear, shared vision for the Detroit city and metro region is required. This can be done by implementing series of events and workshops where community residents, civic leaders and project advisors will meet and together plan activities throughout the process.

To reverse the effect of brain drain and attract more educated people in the region it is necessary to create suitable environment where their needs are met. Transportation reform, new development projects and NSP explained below are the key for transformation of Detroit metro.

Socio-economic disparities

High socio-economic disparities are present in Detroit metro. The composition of the Detroit metro area remains starkly divided; a lower income and predominantly black central city is surrounded by wealthier, white suburbs. A history of racial inequity coupled with continued economic decline in the region over past decades has left significant proportion of the population socially and economically marginalized, with respect to educational attainment and public health. The median income in Detroit city is the lowest income from the aggregated data. This is caused by large income disparities between whites and racial and ethnic minorities. Over the last decade poverty rose more rapidly, and became more concentrated. One in three residents is living in poverty. Disparities also exist in education of minorities; 17 % of black adults and 34 % Hispanic adults in Detroit metro have not completed high school (Metropolitan Opportunity Unit, 2012). These young adults represent a problem, because they are less likely to be employed due to the lack of education and they are more prone to end up in a gang and commit crimes. Crime has been proved as serious problem, Detroit city had three times higher crime rate than was the average for United States. The crime rate remained almost unchanged since 2000. The graph below shows the proportion of law enforcement employees to crime rate by year. Despite the fact that Detroit government did some cuts in the budget and there reduction of law enforcement employees, their remained in the same proportion to the total population of Detroit therefore Detroit city kept higher proportion of law enforcement employees (index was 3.51 in observed interval) than is the average in United States (index was 2.83). Index value is an indicator of the law enforcement employees' level in a region. Higher law enforcement employees' index value means higher law enforcement employees density.

Graph 8 - Crime index in Detroit metro (2005-2012)



Source (Adavameg Inc., 2014) and (World Media Group, LLC, 2014); own work

Proposals: The elimination of crime is a more complex problem. According to the graph number 10 increasing number of law enforcement employees does not seem to be solution; the crime changed over time although the proportion of law enforcement employees to the total population remained same. Deeper analysis of crime is required. The analysis should include characteristics of crime, location, frequency and patterns. Based on data from estimated model and literature review crime can be reduced by removal of quality of life issues such as graffiti, abandoned vehicles, vacant houses, debris, repairing street lighting etc.; by reducing the response time to emergency calls and by having targeted patrols in areas with highest crime rate.

Racial inequity and strict structural separation of races is another cause of Detroit’s decay. Revitalized houses and areas open up new territory which can be repopulated by mix of populations previously divided by race and income. The policies and projects should place emphasis on development of culturally and racially blended environment.

Unemployment and access to jobs

Unemployment level is among the highest in the United States. In 2012 there were 22.8 unemployed residents. Between the years 2000 and 2010, employment losses were concentrated among lower-paying jobs. Despite greater density of jobs and fewer job losses in the central business district and central city areas, the majority of the region's jobs remain in suburban areas (U. S. Department of Commerce, 2012).

Proposals: Detroit city have to become more attractive to investment and economic development along with improving access to jobs for all people, especially low-income households, by promoting transportation policy reform and expanding public transit service. The city should invest in set of prototypical projects to show the investment potential of the area and attract new private investment. Alternatively reduction of unemployment can be achieved by attracting more educated young people back to the city.

Abandoned property, affordable housing

Housing is serious problem of Detroit city is the number of vacant, abandoned buildings and unmaintained parks. Depopulation of the city caused decrease of property value, some houses in the region has literally no value at all. In the collected data set Detroit city was ranked last in value of owner occupied housing units. Average value for houses in was estimated at 53 900 dollars in 2010. Average value in the data set was 105 176 dollars. Taking in account combined housing and transportation costs, only one third of metro neighborhoods are affordable for the typical household.

Proposals: The issues above might be addressed by reconstruction of vacant and abandoned properties and revitalizing neighborhoods to attract new residents. To achieve such goal several number of organizations working in neighborhoods must be built to acquire key properties and strategically deconstruct or reconstruct them to the highest green standards. Elimination of blight will result in economic revitalization in order to stabilize the neighborhoods and begin to repopulate them.

An organization which will provide pre and post-purchase homebuyer counseling should be created to protect low-income families from risk connected with

buying new property. This organization will help to concentrate people in revitalized areas and create favorable environment for urban development.

Several programs focused on revitalization of neighborhoods are currently running in Detroit metro. The city should strengthen them by providing informational and financial support for them or the recipients of the program. For example: the city should provide lines of credit to recipients of Neighborhood Stabilization Plan (NSP). This program provides funds to grantees for the purchase and redevelopment of abandoned or foreclosed homes or residential properties that will be used to house individuals or families. The plan is focused on whole population, especially low-income families. NSP is designed to strengthen neighborhoods that have a steady tax base, a high percentage of home ownership and requires minimal investment to continue stability; and to redevelop neighborhoods with extreme blight and significant amount of abandoned structures. It is expected that eliminating blighted structures will have huge stabilizing impact for future development of neighborhoods (City of Detroit, 2014).

Currently the city of Detroit has received third round of funding from NSP. According to the review of the program, the city of Detroit improvement of strategy in selection and redistribution of received funds is desirable (City of Detroit, 2014).

Transportation

Nearly one in five households within the city of Detroit is transit dependent, although efficiency and effectiveness of current transit operators has been improved in recent years, there is still room for improvement. Within the city of Detroit 1/6 of households do not have access to a vehicle moreover there is no commuter rail system and residents complain about the spottiness of its bus service (Metropolitan Opportunity Unit, 2012).

Proposals: Comprehensive Regional Transit Service Plan is the key plan focused on improvement of transportation in Detroit metro. The city of Detroit and state representatives should increase support for the plan and try to focus its early development on improved mobility and access to jobs for low-income people. This plan was created in cooperation with existing transit provides and serves to coordination of

improvement of existing transit services and the connectivity with new mass rapid transit systems in Detroit metro region. The first stage of the plan is increase of integration between operators and information of public transport within the region. The second stage of the plan is to restore routes and create new routes to areas currently without service. This stage includes creation of new rail system, change of routes so they will correspond with areas of new development or where job opportunities are high and increasing frequency of bus transit. New transit reform will make Detroit metro more competitive for jobs (Semcog.org, 2008).

5 Conclusion

The main goal of the thesis was to define the most important factors which led the city to the state in which is now. Main hypothesis was that decline of automotive industry, shift of production to developing countries, was together with high crime the main cause of Detroit decay. Literature research pointed out that the Detroit metro was built on automotive industry and became intensively dependent on it. After the World War II due to the automatization and shift of production, jobs ceased to exist. Although no significant correlation between the automotive industry and population loss in the selected cities was found in the econometric model. Even though cities with larger share of residents working in manufacturing had overall higher median household income, exactly opposite to case of Detroit metro. Thus based on the model we can say that the inability to quickly adapt new conditions resulted in that thousands of people started to leave the Detroit city.

Based on the econometric model it was found that vacancy rate and construction rate calculated for last decade are most significant characteristics which determine population growth or loss in the model. Those variables were later identified rather as consequences, not causes of city decay. Financial security was, based on second econometric model, identified as the main pull factor. People are moving to cities where they can find higher income, certainty of jobs, cheaper goods and services and financial security in retirement. Surprisingly house value, and cost spent on housing had low impact on overall migration. Location of cities, climatic conditions in the area and occurrence of disasters was determined as second factor which had significant influence on migration, thus population growth. Detroit cannot boast with favorable climate therefore it has to build on economic stability and lucrative jobs.

Auxiliary models dealt with two factors which had most significant impact on financial security; Median household income and unemployment. Three variables had significant impact on both factors. It was educated people index, mean travel time and crime. Those indicators were taken into account in socioeconomic analysis and subsequent proposals.

The estimated models showed that outputs are relevant and can be applied on case of Detroit metro. Some variables confirmed their significance some showed exactly opposite trend.

The secondary goal was to propose possible development of the city, with regard to researched data and situation in the world. Proposals suggest that city of Detroit should encourage civic engagement through shared information about the state of the city and ongoing projects, and vision of Detroit future development. The city of Detroit in order to restore economy have to shrink, create at first separated areas which will be centers for economic growth, later on these areas will grow and create fully revitalized city, built on new pillars. Three key policies and projects were determined, and should be invested in at the expense of other areas, to shape Detroit future. The city of Detroit should invest in prototypical projects to show the investment potential of the area. One of these projects is Comprehensive Regional Transit Service Plan; completion of this plan will result in improved transit infrastructure and better access to jobs through increased frequency and new routes of bus transit and creation of rail transit. Another crucial project is Neighborhood Stabilization Plan; plan includes elimination of blight in whole city and reconstruction and revitalization of targeted areas, new islands of economic growth in large sea of decayed neighborhoods in Detroit. The last pillar is improvement of crime rate. Based on data from estimated model and literature review crime can be reduced by removal of quality of life issues such as graffiti, abandoned vehicles, vacant houses, debris, repairing street lighting etc.; by reducing the response time to emergency calls and by having targeted patrols in areas with highest crime rate. Further analysis of trends, type of crime and location of crimes is needed.

Proposed policies will consume millions dollars, but with focus on revitalization of targeted areas, proposed policies will have soon visible results.

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Annex I - Detroit characteristics - data 2000-2012; part I.

Year	Net population growth (%)	Total population	Population density per sq mile	Median age	Total housing units	Vacant housing units (%)	Owner occupied housing units value (\$)	Mean travel time to work (min)	People working in manufacturing (%)
2000	0	951270	6856	30,9	375096	10,31	63600	27,5	18,78
2001	-3,22632	920579	6634	31,0	375453,5	11,79	71556	26,1	17,65
2002	-3,33388	889888	6413	31,2	375811	13,27	79513	24,8	16,53
2003	-1,15891	879575	6339	31,3	379284	14,44	82113	24,7	17,37
2004	-4,49865	840006	6054	32,4	373610	17,09	89759	25,5	18,19
2005	-0,47023	836056	6025	32,5	375151	17,03	88300	25,7	15,90
2006	-0,23204	834116	6011	33,0	374428	22,95	91700	26,0	17,00
2007	-3,09178	808327	5825	33,7	369743	25,36	88800	26,8	14,80
2008	-3,81455	777493	5603	35,0	365058	27,78	82900	26,4	11,50
2009	-4,09753	745635	5373	34,9	357114	25,30	68400	25,7	11,97
2010	-4,2726	713777	5144	34,8	349170	22,83	53900	25,0	12,44
2011	-1,01614	706524	5092	34,7	349304	22,83	50200	26,4	11,98
2012	-0,71463	701475	5055	34,8	349174	22,83	50200	26,9	11,91

Source: (U. S. Department of Commerce, 2012), own work

Annex II - Detroit characteristics - data 2000-2012; part II.

Year	Unemployment (%)	Employed people	Median household income dollars	Income per capita dollars	Below poverty population percentage	Monthly owner costs for housing (%)	Educated people index	Crime index per 1000 inhabitants	New construction permits
2000	13,92	331441	29526	14717	26,08	21,0	11,92	1163	72
2001	15,11	326124	29993	15052	27,79	21,3	11,97	1111	56
2002	16,31	311487	30461	15387	29,50	20,5	12,02	1055	184
2003	14,58	322457	26157	14418	30,10	20,8	12,07	1066	382
2004	14,72	298172	27871	14573	29,10	19,2	12,12	967	350
2005	14,98	303485	28069	17442	31,40	18,6	12,17	1085	277
2006	13,63	298634	28364	13977	32,50	18,3	12,22	1184	249
2007	15,49	295822	28097	15284	33,80	17,6	12,27	1107	154
2008	20,40	235799	28730	14976	30,30	18,2	12,30	938	85
2009	24,90	224837	27258	14547	33,95	17,8	12,34	932	32
2010	22,80	216137	25787	14118	37,59	18,3	12,37	888	134
2011	20,00	216137	26428	13965	37,80	18,4	12,41	1037	18
2012	18,70	216137	26995	13857	38,12	18,0	12,45	1023	4

Source: (U. S. Department of Commerce, 2012), own work

Annex III - Characteristics of selected cities (average 2008-2012) part I.

City	Net population growth (%)	Median age	Vacant housing units (%)	Owner occupied housing units value (\$)	Mean travel time to work (min.)	Manufacturing people working (%)	Unemployment (%)	Median household income dollars	Income per capita dollars	Below poverty population (%)	Monthly owner costs for housing (%)	Educated people index
Albuquerque	21,68	35,1	6,20	190,3	21,1	5,7	7,98	47,399	26623	17,3	10,1	13,9
Atlanta	0,85	32,9	17,56	228,8	25,2	5,7	14,93	41,631	30688	24,4	20,9	14,2
Austin	20,38	31,0	8,29	216,7	22,5	7,7	4,40	52,431	31387	19,4	12,7	14,2
Baltimore	20,38	31,0	8,29	216,7	30,2	7,7	4,40	52,431	31387	19,4	12,7	14,2
Birmingham	-12,59	35,4	17,98	87,2	21,6	8,4	14,56	31,467	19615	28,9	14,6	13,1
Boston	4,83	30,8	7,26	374,0	29,5	4,5	10,27	53,136	33589	21,2	14,7	14,1
Buffalo	-10,71	33,2	15,67	66,7	20,2	8,8	13,60	30,502	20245	30,1	13,7	13,1
Cincinnati	-10,36	32,5	17,18	126,9	22,0	11,0	11,60	33,708	24538	29,4	14,1	13,5
Cleveland	-17,05	35,7	21,70	80,9	24,2	12,5	19,56	26,556	16812	34,2	15,7	12,4
Columbus	10,62	31,6	10,61	134,9	20,8	7,4	9,20	43,992	24075	22,0	13,2	13,7
Dallas	0,78	31,8	11,34	129,3	25,4	8,4	9,13	42,436	27011	23,6	13,8	12,9
Denver	8,21	33,7	7,94	246,3	24,8	5,3	8,56	49,091	32597	18,9	10,7	13,4
Detroit	-24,97	34,8	22,83	53,9	26,4	12,4	22,80	25,787	14118	37,6	24,1	12,4
El Paso	15,16	32,5	4,71	116,6	22,1	7,6	7,86	40,808	19262	22,3	11,3	12,8
Forth Worth	38,62	31,2	9,77	121,1	26,1	12,2	9,22	51,105	24338	17,4	13,6	13,0
Houston	7,46	32,1	12,32	124,7	26,0	9,3	8,99	44,648	27029	22,2	12,6	12,9
Charlotte	35,24	33,2	9,40	173,2	24,1	8,0	10,47	52,916	31653	16,0	11,7	14,0
Chicago	-6,92	32,9	12,46	132,4	34,7	9,5	12,86	47,408	28202	22,1	15,4	13,5
Indianapolis	4,93	33,7	12,55	119,9	22,4	11,1	11,35	42,144	24182	19,9	12,1	13,2
Jacksonville	11,71	35,5	11,79	157,2	23,3	6,3	11,14	48,143	25433	16,1	12,5	13,4
Las Vegas	22,01	35,9	13,14	184,9	25,1	3,0	12,84	52,601	26098	16,2	12,1	13,0

Source: (U. S. Department of Commerce, 2012), own work

Annex IV - Characteristics of selected cities (average 2008-2012) part II.

City	Net population growth (%)	Median age	Vacant housing units (%)	Owner occupied housing units value (\$)	Mean travel time to work (min.)	Manufacturing people working (%)	Unemployment (%)	Median household income dollars	Income per capita dollars	Below poverty population (%)	Monthly owner costs for housing (%)	Educated people index
Los Angeles	2,65	34,1	6,78	470,0	29,9	9,3	11,41	49,745	28111	21,2	12,9	13,0
Louisville/Jefferson	6,22	37,1	9,04	139,4	21,8	11,3	11,03	44,111	25623	18,2	11,5	13,5
Memphis	-0,49	33,0	14,23	98,3	21,3	8,0	13,51	36,817	21368	26,2	14,2	13,1
Milwaukee	-0,36	30,3	9,92	134,4	21,8	14,4	13,25	35,823	19199	28,3	17,4	12,9
Nashville	10,21	33,7	8,66	165,0	23,0	7,3	8,72	45,892	27369	19,0	11,2	13,7
New Orleans	-29,06	34,6	25,14	183,8	22,7	4,2	11,86	36,681	26131	27,2	14,0	13,7
New York	2,08	35,5	7,75	501,5	40,9	4,1	10,16	51,865	31661	14,9	14,7	13,4
Newark	1,31	32,3	13,68	264,4	31,8	8,0	17,85	34,387	17161	28,0	22,9	11,9
Oklahoma	14,59	34,0	10,39	131,0	19,6	7,1	6,57	45,704	25629	17,6	11,6	13,4
Philadelphia	0,56	33,5	10,51	142,3	32,3	7,0	14,50	37,016	21946	26,2	15,8	12,9
Phoenix	9,43	32,2	12,77	174,1	24,5	7,7	9,61	47,866	24110	21,8	12,1	13,1
Pittsburg	-8,63	33,2	12,77	88,5	23,2	5,5	9,27	38,025	26535	22,5	14,2	14,0
Portland	10,33	35,8	6,36	288,3	24,2	9,7	10,05	51,238	31249	17,2	14,5	14,4
San Antonio	15,97	32,7	8,51	113,1	23,2	5,9	8,12	44,937	22568	20,1	11,9	13,0
San Diego	6,87	33,6	6,38	451,8	22,1	9,4	9,14	63,99	33012	15,4	10,0	14,2
San Francisco	3,67	38,5	8,26	750,9	30,8	5,9	8,02	73,802	47278	13,2	10,1	14,5
San Jose	5,70	35,2	4,04	575,5	26,0	19,5	10,29	81,349	33807	11,8	10,0	13,7
Seattle	8,04	36,1	8,11	441,0	25,3	7,1	6,67	63,47	42369	13,2	13,4	15,2
Tampa	10,63	34,6	13,48	173,5	22,3	5,0	11,73	43,514	28779	21,1	13,6	13,6
Tucson	6,87	33,0	10,61	153,7	21,5	6,4	11,01	36,939	20393	24,4	12,7	13,3
Washington	5,19	33,8	10,11	443,0	30,3	1,3	10,52	64,267	45004	18,5	10,4	14,8

Source: (U. S. Department of Commerce, 2012), own work

Annex V - Characteristics of selected cities (average 2008-2012) part III.

City	Crime index crime per 1000 inhabitants	New constru- ction permits	Purchasing power index (%)	Cost of living	Quality of life index (%)	Culture index (%)	Medical index	Consumer price index (%)	Restaurant index (%)	Education index (%)	Earthquake tornado index (%)	Pollution index	Price to income ratio house (%)	Mortgage as percentage of income (%)	Climate index (%)
Albuquerque	474,0	17,7	128,2	103	191,8	187	68,5	73,3	168	186	123	29,1	1,9	14,7	152
Atlanta	551,8	23,3	162,2	94	153,3	196	65,0	75,1	180	192	165	73,6	2,7	20,2	173
Austin	412,1	20,7	117,6	102	175,2	189	73,6	84,8	172	187	185	44,2	3,3	25,5	184
Baltimore	412,1	20,7	117,6	102	175,2	189	73,6	84,8	172	187	185	44,2	3,3	25,5	184
Birmingham	853,2	6,2	131,7	78	141,4	193	56,2	71,9	166	188	70	70,7	1,7	12,8	129
Boston	396,7	6,4	113,8	149	191,2	198	79,4	93,6	173	191	69	24,6	4,2	30,0	94
Buffalo	696,3	1,7	126,8	77	186,1	193	77,8	81,8	135	191	89	32,1	2,1	15,4	22
Cincinnati	653,7	4,0	155,0	86	155,0	196	54,2	76,3	195	192	164	48,3	2,2	14,2	63
Cleveland	728,3	3,5	115,1	84	162,9	192	83,3	88,3	142	187	73	37,1	1,9	6,5	34
Columbus	594,9	12,4	113,3	87	178,0	190	53,5	77,4	173	188	75	39,7	1,6	11,8	46
Dallas	485,6	12,1	138,9	88	173,8	192	74,1	79,0	165	188	278	64,7	3,9	30,6	173
Denver	394,0	13,3	132,2	110	210,6	195	85,6	79,3	174	190	292	33,4	1,8	13,6	103
Detroit	888,7	2,3	134,8	79	161,5	193	58,3	78,9	110	183	100	55,5	1,2	9,2	34
El Paso	258,5	15,8	154,7	86	146,4	180	77,8	67,2	155	144	79	27,6	3,4	13,4	191
Forth Worth	422,2	27,6	114,0	90	141,7	193	71,7	69,2	153	178	269	71,1	3,1	21,2	158
Houston	546,1	14,5	116,1	89	137,8	191	75,8	88,8	153	187	370	68,7	2,6	19,6	149
Charlotte	404,9	24,8	145,7	93	223,0	188	76,4	70,9	169	189	107	37,9	2,3	17,4	156
Chicago	557,6	8,1	120,5	88	177,5	189	62,9	80,5	144	189	212	34,0	2,6	19,9	22
Indianapolis	615,6	10,2	150,1	90	202,9	171	56,5	72,1	143	159	240	21,8	1,5	10,9	55
Jacksonville	432,6	20,5	124,2	88	172,0	189	56,9	68,5	154	186	179	27,6	1,5	11,3	149
Las Vegas	354,8	23,3	147,4	94	179,5	183	65,3	76,2	137	173	126	50,0	2,6	19,2	192

Source: (U. S. Department of Commerce, 2012), own work

Annex VI - Characteristics of selected cities (average 2008-2012) part IV.

City	Crime index crime per 1000 inhabitants	New constru- ction permits	Purchasing power index (%)	Cost of living	Quality of life index (%)	Culture Index (%)	Medical index	Consumer price index (%)	Restaurant index (%)	Education index (%)	Earthquake tornado index (%)	Pollution index	Price to income ratio house	Mortgages percentage of income (%)	Climate index (%)
Los Angeles	301,2	5,8	130,2	144	156,6	192	66,8	70,3	145	188	433	56,9	4,8	35,5	199
Louisville Jefferson	486,6	12,4	116,2	84	122,0	195	58,3	81,1	173	182	79	41,0	1,7	11,3	90
Memphis	760,8	6,9	120,9	75	109,3	193	38,9	79,1	162	187	253	101,7	1,3	9,8	149
Milwaukee	589,3	3,3	126,5	86	179,8	193	65,7	68,3	149	189	98	39,1	2,1	16,3	43
Nashville	544,1	14,2	143,4	98	202,4	195	83,3	71,5	185	192	78	43,1	1,7	12,1	100
New Orleans	413,0	7,6	107,9	92	147,4	195	63,9	79,3	161	190	144	51,7	2,9	21,5	161
New York	243,8	5,6	100,0	169	124,5	199	54,8	100,0	190	196	116	52,0	8,2	59,0	98
Newark	544,1	12,6	111,3	112	155,1	193	60,1	78,1	113	186	111	43,8	1,5	16,2	69
Oklahoma	567,4	14,0	127,6	86	216,7	189	56,9	71,5	167	185	354	22,6	2,8	21,1	138
Philadelphia	567,7	3,3	115,6	101	143,4	193	58,9	91,1	136	191	108	51,2	2,8	20,0	94
Phoenix	378,0	17,6	138,4	88	160,3	190	68,0	73,9	152	187	90	76,8	1,7	12,1	197
Pittsburg	274,9	3,6	116,2	85	165,0	198	55,6	74,6	167	193	19	50,0	2,1	15,4	43
Portland	392,7	11,3	112,9	116	214,0	194	77,8	73,4	176	190	192	29,2	3,5	24,8	143
San Antonio	487,6	18,1	128,4	86	185,4	187	54,2	71,8	166	187	144	35,4	1,8	12,7	180
San Diego	242,2	10,4	137,9	143	184,6	196	65,3	78,6	168	187	279	42,6	2,8	20,1	200
San Francisco	365,8	6,3	106,7	199	153,8	198	74,2	92,1	173	192	457	40,4	9,5	68,3	200
San Jose	232,2	10,1	130,8	168	159,6	190	60,4	86,1	139	186	466	58,6	4,2	31,3	199
Seattle	398,2	13,0	118,9	143	189,0	197	70,8	89,7	179	185	336	31,3	4,2	29,9	146
Tampa	381,6	17,9	143,2	88	216,4	189	76,9	75,5	175	180	470	27,2	2,1	16,7	195
Tucson	418,4	12,6	115,1	91	190,1	189	68,1	85,3	163	187	60	29,4	4,0	28,2	196
Washington	556,3	7,6	111,5	143	150,3	196	61,1	97,4	180	188	77	30,8	5,4	38,1	100

Source: (U. S. Department of Commerce, 2012), own work

Annex VII - Multicollinearity in the model part I

	Net popul	Total popul	Population	Median age	Vacant ho	Owner oc	Mean trav	Manufac	Unempl	Median h	Income h	Below po	Monthly	Education	Crime ind
Net population growth percentage	1	-0,1142	-0,3387	-0,1764	-0,5905	-0,0247	-0,2051	-0,1755	-0,6972	0,3599	0,1727	-0,6251	-0,6608	0,2195	-0,4934
Total population		1	0,7687	0,0879	-0,1668	0,314	0,1547	-0,1084	-0,0189	0,0798	0,0715	-0,1465	0,0589	-0,1469	-0,2934
Population density per sq mile			1	0,0634	-0,0515	0,3578	0,1833	-0,1116	0,2424	0,0871	0,1619	0,049	0,2561	-0,0366	-0,1012
Median age				1	0,0434	0,4271	-0,1492	-0,0479	0,1992	0,2721	0,295	-0,298	-0,1593	0,1717	-0,1072
Vacant housing units percentage					1	-0,4938	0,0336	0,0641	0,777	-0,6418	-0,4603	0,7434	0,6921	-0,4433	0,76
dollars						1	0,2154	-0,0947	-0,28	0,8287	0,8109	-0,5881	-0,3281	0,5978	-0,5799
Mean travel time to work minutes							1	-0,207	0,0301	0,0374	0,1984	0,0622	0,1187	0,1035	-0,002
percentage								1	0,2701	-0,0406	-0,3475	0,212	0,1839	-0,3249	0,1587
Unemployment percentage									1	-0,5501	-0,4945	0,7309	0,7226	-0,5221	0,6023
Median household income dollars										1	0,846	-0,8435	-0,5917	0,6925	-0,6648
Income per capita dollars											1	-0,7031	-0,4231	0,855	-0,4767
Below poverty population percentage												1	0,7327	-0,6306	0,7417
Monthly owner costs for housing without mortgage percentage of total													1	-0,3147	0,5818
Education index more means more educated people														1	-0,3525
Crime index crime per 1000 inhabitants															1
New construction construction permits															
Purchasing power index															
Cost of living															
Quality of life index															
Culture Index															
Medical index															
Consumer price index															
restaurant index															
education index															
Earthquake tornado index															
Pollution index															
Price to income ratio house															
Mortgage as percentage of income															
Climate index comfort index															

Source: (U. S. Department of Commerce, 2012), own work

Annex VIII - Multicollinearity in the model, part II

	New cons	Purchasin	Cost of liv	Quality of	Culture in	Medical in	Consumer	restaurant	education	Earthquak	Pollution	Price to in	Mortgage	Climate in
Net population growth percentage	0,6658	-0,0345	-0,0274	0,2854	-0,2871	0,1785	-0,2898	0,2731	-0,2109	0,0519	-0,1766	-0,0102	0,0019	0,4394
Total population	-0,2743	-0,3085	0,3724	-0,3574	0,21	-0,2323	0,3291	0,0939	0,2391	0,0548	0,1873	0,4877	0,497	-0,0708
Population density per sq mile	-0,5427	-0,4073	0,441	-0,3187	0,333	-0,1799	0,5689	-0,0585	0,305	-0,1303	0,0296	0,4877	0,4864	-0,3744
Median age	-0,1952	-0,1122	0,3934	-0,0548	0,148	-0,066	0,1935	0,0107	0,0331	0,2444	-0,2186	0,3077	0,2849	0,0446
Vacant housing units percentage	-0,1265	0,1617	-0,5013	-0,1427	-0,0382	-0,1448	0,0043	-0,4426	0,0448	-0,1955	0,2939	-0,3787	-0,3782	-0,405
dollars	-0,2543	-0,2889	0,9816	-0,0958	0,4598	0,0808	0,4991	0,3206	0,296	0,4463	-0,0637	0,8166	0,8286	0,3272
Mean travel time to work minutes	-0,1233	0,2179	0,2239	0,0444	-0,0499	0,0661	0,0452	-0,0113	-0,0321	0,1269	0,0528	0,1292	0,1757	0,0143
percentage	-0,2246	0,0339	-0,0974	-0,1275	-0,116	-0,0531	-0,2166	-0,5275	-0,1098	0,2107	0,1923	-0,2378	-0,2433	-0,1942
Unemployment percentage	-0,4466	0,1327	-0,2579	-0,2298	0,0665	-0,2046	0,0182	-0,6151	0,0372	-0,2468	0,2073	-0,2721	-0,2937	-0,4989
Median household income dollars	0,1432	-0,1633	0,7885	0,0577	0,226	0,0828	0,301	0,3325	0,1556	0,4715	-0,0771	0,5742	0,6081	0,4515
Income per capita dollars	0,0545	-0,2348	0,7739	0,105	0,4152	0,2129	0,4778	0,5762	0,3134	0,402	-0,1578	0,6543	0,693	0,2917
Below poverty population percentage	-0,4093	0,0842	-0,5515	-0,1873	-0,0304	-0,0447	-0,0528	-0,5126	-0,0264	-0,3755	0,2147	-0,416	-0,451	-0,4825
Monthly owner costs for housing	-0,2657	0,0724	-0,2999	-0,1754	0,2022	-0,1442	0,0109	-0,3725	0,1543	-0,2472	0,2475	-0,1875	-0,1752	-0,4416
without mortgage percentage of total	0,1902	-0,1742	0,5489	0,2826	0,3337	0,1584	0,3052	0,6766	0,2939	0,169	-0,3082	0,3924	0,4347	0,2471
educated people	-0,3155	-0,0374	-0,5544	-0,1264	-0,0522	-0,3199	-0,0394	-0,3605	0,0802	-0,294	0,187	-0,4752	-0,4605	-0,6396
Crime index crime per 1000 inhabitants	1	0,3804	-0,3215	0,2413	-0,306	0,1982	-0,4484	0,2511	-0,2049	0,0046	0,0586	-0,2549	-0,2336	0,5285
New construction construction permits		1	-0,3568	0,3152	-0,4892	0,1242	-0,6242	-0,1837	-0,4768	0,0244	0,0945	-0,4443	-0,4508	0,2403
Purchasing power index			1	-0,097	0,4673	0,1068	0,569	0,296	0,2986	0,3802	-0,1045	0,8369	0,8424	0,2353
Cost of living				1	-0,2618	0,4189	-0,3511	0,1756	0,0146	0,0691	-0,6618	-0,242	-0,1965	0,0115
Quality of life index					1	0,1211	0,4928	0,4004	0,751	0,0524	0,2201	0,4061	0,4335	-0,0575
Culture Index						1	0,0059	0,2054	-0,0115	0,0547	-0,2998	0,1041	0,0587	0,1462
Medical index							1	0,1974	0,3952	0,0066	0,035	0,5942	0,5911	-0,1383
Consumer price index								1	0,3172	-0,0077	-0,2104	0,3307	0,3444	0,2192
restaurant index									1	0,0405	0,1782	0,2193	0,3204	-0,0946
education index										1	0,1451	0,2942	0,3461	0,4227
Earthquake tornado index											1	-0,0603	-0,0262	0,1878
Pollution index												1	0,9839	0,2712
Price to income ratio house													1	0,2794
Mortgage as percentage of income														1
Climate index comfort index														1

Source: (U. S. Department of Commerce, 2012), own work