

Equity in the Chicago public transport system and the influence of the red line extension and congestion pricing



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Abstract

In this master's thesis the equity situation in the public transport system of Chicago is researched. This is done with two case studies. One of them is the red line metro extension on the south side of Chicago and the other one is congestion pricing. The aim of these two case studies is to research the equity effects of two transport investments. With the results of the case studies it is shown what the importance is to address the topic of equity in public transport. Therefore the relevance of this thesis is to research how the equity situation in the public transport system of Chicago can be improved. This is also the main goal of this thesis and what the thesis tries to add to the research field. The theoretical background shows that there is not one right way to measure equity, but that it depends on the context of a specific city. For this thesis a literature review, a data analysis and interviews with experts have been used. It is argued that the context of the city of Chicago is important for the investigation of relevant equity aspects. Relevant indicators for measuring equity are presented, which have also been used in the data analysis. It is shown that areas with lower incomes have in general a longer commute time than people with higher incomes. The red line extension has a positive influence on the vertical equity of commute times in the public transport of Chicago. Furthermore, the red line extension will probably have a positive influence on the economic development of the region. It is concluded that alternatives for congestion pricing have to be provided for people with lower incomes in order to be equitable. This means that it is important to compensate with alternative modes of transport for the increasing inequity of congestion pricing. Finally, it is argued that the construction of the red line will probably meet its objectives.

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Chapter 1 Introduction to the topic

In geography, there has been a debate for a long time about the relationship between geographical variation and the provision of public transport (Hay, 1993). Public transport creates liveable cities by enabling the flow and mobility of people (Farmer, 2011). It keeps the urban economy running by place-based advantages and attracts investments in local markets. But public transportation can also be seen as an instrument of social control, by providing uneven opportunities to people in different neighborhoods and in this way uneven geographical development in different neighborhoods is created (Farmer, 2011). The impacts of new public transport infrastructure can create a better quality of life, greater accessibility and social inclusion, particularly for people without cars (Foth et al, 2013).

For these reasons, public transportation planning is an important issue for cities, but it is a complex task (Welch & Mishra, 2013). What makes it even more complex is the question: Who should benefit from public transportation? Whereas one can argue that the benefits from public transportation should be distributed equally over space, others argue that residence groups that lack private transportation should benefit more (Welch, 2013). This is an issue with which equity in public transportation is concerned.

Equity and its role in public transport

The first thing which has to be done before doing research to equity impacts in public transport is to define what equity is and to elaborate on different aspects of equity. According to Ecola & Light (2009) equity is concerned with the costs and benefits that accrue to different members of society. According to Levinson (2009) equity can be used as a descriptive term as well as a normative term. The normative term gives a certain degree of equity to the word. The term equitable can be derived from equity. Ecola & Light (2009) state that a policy is equitable when it meets a set of normative standards of fairness. This means that equity is an objective term, whereas equitable has a subjective element within it. It also means that a policy can never be 100 percent equitable, since it is a subjective term. The question: What is equity will be discussed more extensively in the theoretical background.

Equity will be researched in this thesis in the context of public transport in the United States. It is an issue in public transportation in the United States since the civil rights act of 1964. Due to this civil rights act all federal funding for public transportation requires that the plans have incorporated equity impacts for social equity and environmental equity (Manaugh et al, 2015). The role of equity in public transport is sometimes hard to measure, since there are different kinds of equity and different ways to measure equity effects (Litman, 2015). Manaugh et al (2015) have developed a framework to evaluate equity objectives and measures, in which they made a comparison analysis between big cities in North America, and the way how they address equity issues. According to Manaugh & El-Geneidy (2011) public transport has to provide accessibility for all people, but this is often constraining with another major goal, gaining profit. Different kinds of equity and different ways to measure equity are a crucial part of this thesis.

Public transport in Chicago

The public transport system of Chicago consists of a large network and is a complex system. According to Farmer and Noonan (2014) there are a lot contradictory forces operating in the Chicago Mass Transit system. Farmer and Noonan (2014) state that the public transport organizations are first focusing on securing the revenues streams for the union bureaucracy and second to provide service. According to Farmer (2011) the public transportation system in Chicago reveals the uneven geographic development and the right to the city for working people and minorities. Most projects are focused on the central area, to create place-based advantages and to elevate its global cities status, although people in lower-income neighborhoods don't take a profit from these investments, whereas they are the ones who need it the most.

Therefore it is interesting to research the equity effects of the public transport in Chicago. The literature suggests that there is an uneven geographical development in the public transport system. This thesis will test these findings from the literature in three ways. The public transport will be investigated, and by using two case studies, there will also be a more detailed focus on equity effects in the transit system of Chicago. These case studies are the equity effects of the red line extension in Chicago and the effects of implementing congestion pricing on public transport. These two cases will now be introduced.

Red line train expansion Chicago

One factor that influences the equity in a public transport system is the investments of new infrastructure (Farmer, 2011). For this thesis the proposed red line extension is used as a case to research the equity in the transit system of Chicago. The Chicago transit authority is planning a lot of projects to improve the public transport system. One of them is the proposed extension of the south red line train which will pass through highly segregated (95 % blacks) and low income area (Farmer, 2011). For this thesis the equity impacts of such a project will be interesting to analyse.

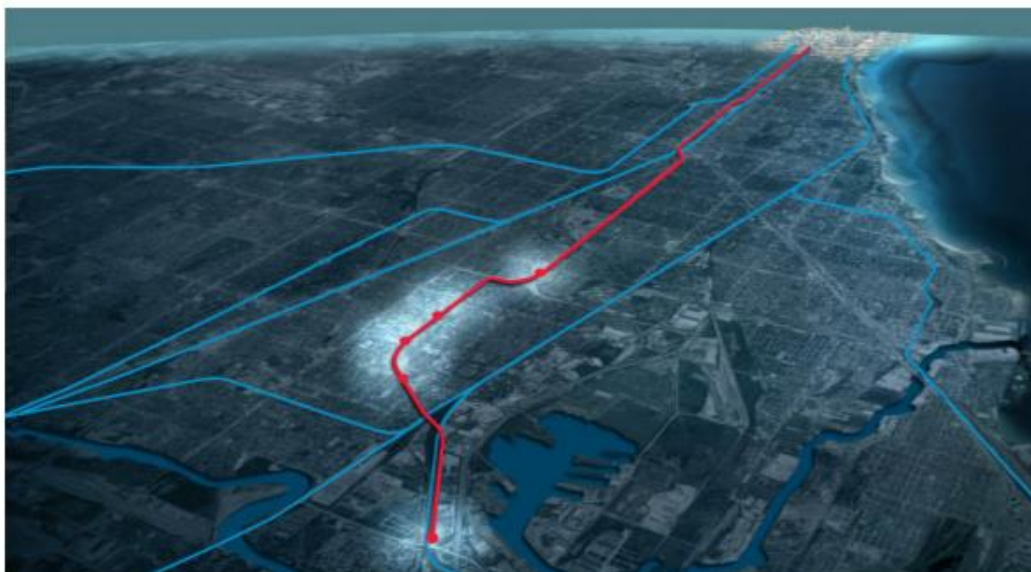


Fig. 1 The proposed extension of the red line train to the south side of Chicago (CMAP, 2016).

The plan for the red line extension is to extend the rail line from the current end station at 95th street to 130rd street. The extended rail line will make use of current rails which are not in operation anymore. The project is visualized in figure 1, where it can be seen that the extended rail line will add stations to the current red line. According to Farmer (2011) the projects which the city of Chicago wants to execute in the downtown area contribute to the neglecting of the south side region. Addie (2013) also states that the city of Chicago is especially interested in the global connectivity, which causes that poorer regions are neglected. The Chicago Transit Authority (CTA) has already proposed the extension of the red line train forty years ago. According to the city of Chicago (2009) the red line extension would be finished in 2016, but according to the CTA the red line extension project is far from finished (Tandon, interview 2016). The CTA acknowledges that the infrastructure project is needed since travel times in this area are way higher than in the rest of the city, so it would improve the mobility and accessibility of this region of the city (CTA, 2016). But, sixty years after the first proposal it is still not clear if the project will go on, despite the fact that it has already been funded for over half 1 billion by federal money (Farmer, 2011).

Congestion pricing

Another aspect which could influence the situation of equity is the planned introduction of congestion pricing. Congestion pricing is a way to include a price for road users, which is now a cost for the economy. Congestion pricing is a way of internalizing the extra costs which each individual makes because of extra congestion they cause for others. Worldwide more and more cities are implementing congestion pricing. It has become a more promising option for policymakers to address urban traffic-congestion problems (Ecola & Light, 2009). Transport economists and traffic planners think of it as an effective instrument to reduce the congestion in big cities (Eliasson, 2008). Congestion pricing has first been introduced in Singapore, and was followed later by London and Stockholm. In the United States there were initially a lot of congestion pricing proposals rejected, because it might be inequitable (Ecola & Light, 2009). Since then a few congestion pricing projects have been implemented in the United States, for example in California and Minnesota (Cao & Munnich, 2012; Sullivan, 2000).

With congestion pricing express lanes are added next to existing highways which will be priced. This means one part of the highway can be used for free and one part will be a toll lane. When tolls are implemented the trips with a lower value of time will often be excluded (Vickrey, 1969). Since the value of time is related to the wage rate (Rouwendal & Nijkamp, 2004), poorer people will probably be the ones who will not use the express lanes but use the free lanes, which have longer travel times. The Chicago Metropolitan Agency for Planning (CMAP) (2010) has also named its potential regressivity one of the main pitfalls of congestion pricing. But according to the CMAP (2016, interview) the poorer people will also have to use the express lanes when they have to be in time for an appointment. The CMAP also wants to invest the benefits of congestion pricing in public transport, for example in the red line extension, but if there will be any benefits it is hard to invest these in public transport, because of political reasons (CMAP interview, 2016). Since the express lanes are operated by a public private partnership it makes it difficult to transfer this money to the CTA. Also, it takes a long time before there will be any benefits, because of the high costs of implementing congestion pricing.

The state of Illinois has proposed congestion pricing as one of its transport strategies for 2011-2040. Congestion pricing is seen as an important tool to reduce congestion and to contribute to a productive regional economy (Chicago Metropolitan Agency for Planning, 2010). According to the Chicago Metropolitan Agency the highway system is currently in a bad condition. Therefore it should implement congestion pricing to keep up with other industrialized and emerging economies around the world (Chicago Metropolitan Agency for Planning, 2010).

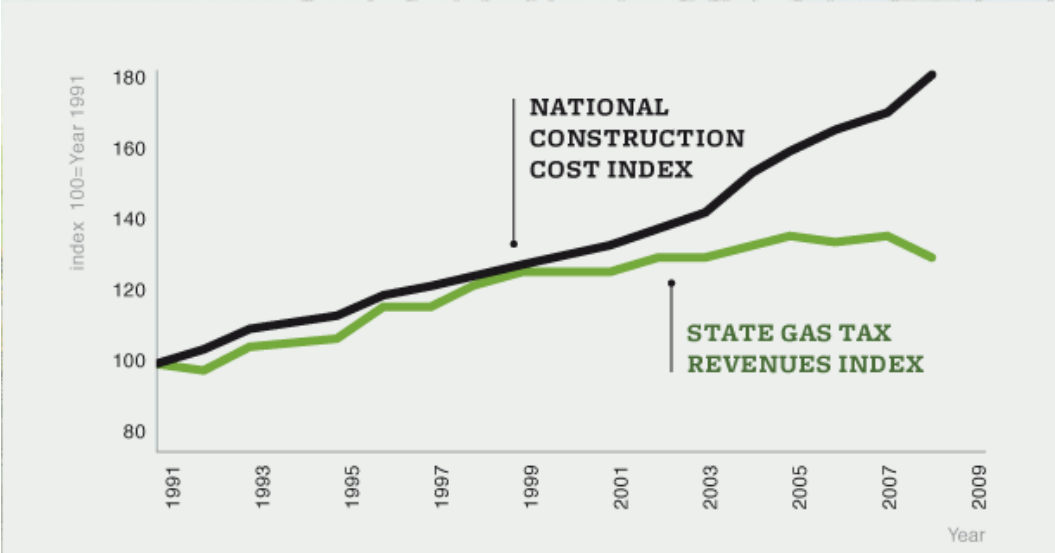


Fig 2. National construction costs and state gas tax revenues in the last twenty years. (Chicago Metropolitan Agency for Planning , 2010)

The main reason why congestion pricing has been proposed in Illinois is because of stagnating state gas tax revenues as can be seen in figure 2, whereas the construction costs have grown exponentially in the last twenty years. With congestion pricing the gap between the construction costs and the gas tax revenues can be closed, CMAP argues.

The relevance of the two case studies

Since the lower-income people make in general more use of public transport than richer people (Vandyck & Rutherford, 2013; Garret & Taylor, 1999) and because on the south side of Chicago there live in general poorer people than in other parts of the city, it is likely that the red line extension will benefit poor people more than others. The effect will be different for different kind of equities, which will be discussed in the theoretical background. The case of congestion pricing does not seem as straightforward as the red line extension, but they are in some way linked to each other, because potential revenues of congestion pricing can go to public transport projects, like the red line extension (CMAP, interview 2016). Also, there is the possibility that poor people will change their travel mode to public transport, because of the introduction of congestion pricing, which can make the demand for the red line extension bigger.

1.2. Research design

Research problem

The current situation of equity in the Chicago public transport system is not clear. First, it is not clear what aspects of equity should be taken into account when addressing the issue to public transport and what indicators should be used to measure equity. These aspects of equity and these indicators first have to be researched in order to analyze the current situation of equity in the public transport of Chicago. Also, it has to be researched to what extent the equity situation can change. These aspects and indicators have to be researched by studying the literature and conducting interviews, after which a data analysis can be executed. The CMAP has proposed the concept of congestion pricing in Chicago. According to the CMAP (2010) the equity effect is one of the main pitfalls of the congestion pricing system. The reason for this is because of its potential regressivity, since the effects will affect low income people more than high income people (CMAP, 2010). The extension of the red line train is a proposal of the CTA, but it is not clear how this will affect the equity of the public transport system in Chicago, because this is different for different kinds of equity and it depends on the indicators which are chosen to investigate the equity.

Research goal

The main objective of this thesis is to investigate the equity situation of the Chicago public transport system and how this situation can be influenced. Since it is hard to define equity and because there are different aspects, first it has to be determined what equity is and what indicators should be used when researching it in regard of public transport in Chicago. Then the current situation of equity in the public transport of Chicago can be researched. To measure potential change of equity in the Chicago public transport system two transport investments will be researched. One is the issue of congestion pricing and the other is the extension of the red line train in Chicago. The goal is to measure the effects that these two investments have on equity so it can be analysed what the influence of these transportation projects is. There can be different effects for different kinds of equity and these effects can both be positive as well as negative.

Research question

What is the current situation of equity in the public transport system of Chicago and what could be influences of the red line extension and congestion pricing in this system?

Sub questions

- How can equity be measured and how is it an issue in the current situation of the public transport system in Chicago?
- What are relevant factors in the context of Chicago regarding equity effects of the red line extension and congestion pricing?
- To what extent can the implementation of the red line extension create equity effects on public transport?
- To what extent can the implementation of congestion pricing create equity effects on public transport?

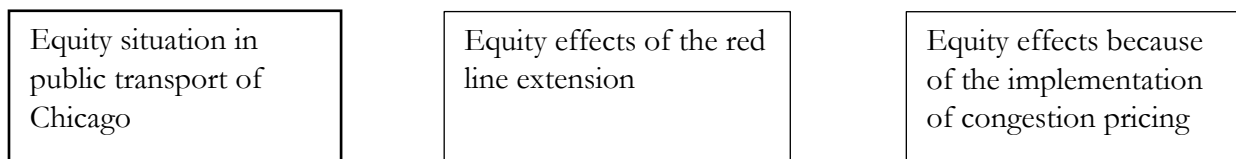
Research Steps

For this research different methods will be applied to answer the research questions: These different methods include literature, case study analysis, interviews and a quantitative data analysis. The first research question on what equity is and the current situation of equity in the public transport system of Chicago will be answered by interviews and literature. The interviews will be used to get a more detailed view on the equity situation in the public transport system of Chicago. The second question will be mainly answered by interviews and especially a quantitative data analysis which will be described in the methodology. The third question focuses on the equity effects of congestion pricing and will mainly be answered by interviews. These two research questions will make up the case study analysis of this thesis. The last research question will be used as a reflection of the previous three questions, which means all previous ways of data collection will be needed to answer this question.

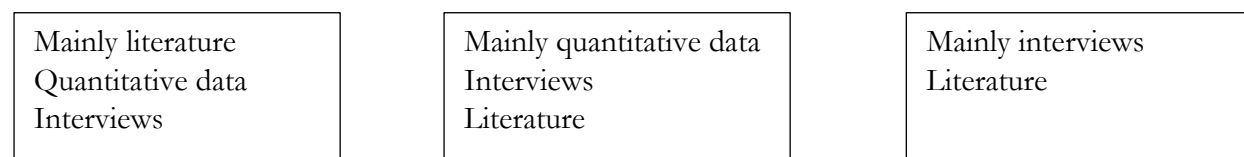
This model below explains the different methods which are used in this thesis to collect the data. The first row represents the three main topics of this thesis which also includes three sub questions. The methodology row represents the methods which are used to answer these questions, with which different kind of results will be gathered. In order to combine these results and formulate a conclusion, the last sub question is important.

Model methodology

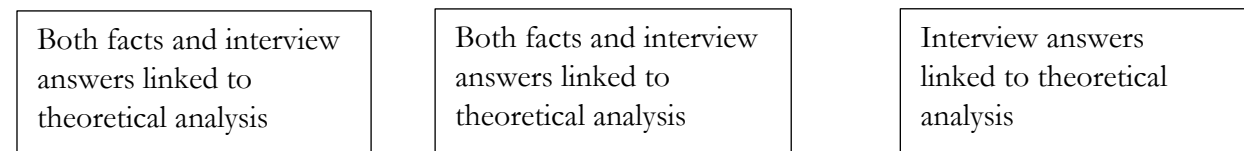
Topics



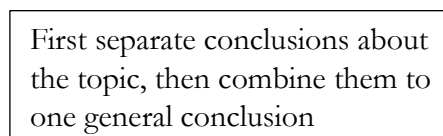
Methodology



Results



Conclusion



Outline of the thesis

In this paragraph the outline of the remainder of this thesis will be discussed. After this introduction, the theoretical background will follow. The theoretical background is used to discuss the link between public transport and equity, to answer the question what equity actually is and what the different aspects of equity are. Also, different ways to measure equity is an important part of the theoretical background. Finally, social justice will be discussed and its link with equity and public transport.

After the theoretical background, the methodology of this thesis will be discussed in more detail. Special attention will be drawn to the case study analysis, and the different research methods will be discussed in more detail. The next chapter will be about the research context of Chicago and what factors are important in the case of researching this topic in Chicago.

After this there will be a chapter in which the two case studies will be described. First the red line extension will be discussed. In this chapter the background, implementation and objectives of the project are the main topics. The same will be done for the case of congestion pricing in Chicago. By using the literature and interviews the factors that influence equity will be determined. These factors will be used in a quantitative data analysis to measure equity effects for the red line extension. Interviews will be used to analyse the effects for the case of congestion pricing in Chicago and the influence on public transport. Finally, there will be the conclusion of the thesis.

Chapter 2 Theoretical background

2.1. Introduction

In this chapter a brief overview of the current theories on the most important theoretical topics for this thesis will be given. First of all, different interpretations of equity will be explained. After this, the concept of public transport will be described in more detail in relation to equity. Then the equity aspects will be linked to public transport. Especially, the aspects of equity which are relevant to public transport are important. Also different ways to measure equity in public transport will be analysed. In the section of social justice in the city some key philosophical ideas about social justice in the city will be discussed. Some discussions about ethical planning are discussed and linked to public transport.

2.2. Equity

As discussed in the introduction, equity can be divided in different categories (Ecola & Light 2009; Levinston, 2009). Equity is about the costs and benefits that accrue to different members of society (Ecola & Light 2009; Levinston, 2009).

Equity can be divided in different categories.

- Horizontal Equity: When members of the same group are treated the same.
- Vertical Equity: When members of the different groups are treated differently.
- Cost principle: The people who contribute to a social cost also pay for doing so.
- Benefit principle: The people who receive social benefits also pay for them.
- Spatial equity: To which extent costs and benefits are distributed equally over space.
- Social equity: To which extent allocation is proportionate to need.

Horizontal and vertical equity

In this section the horizontal and vertical equity aspects will be discussed. These aspects are the aspects which are mostly used in the literature and the thesis. Therefore these aspects will be discussed more extensively, whereas the other equity aspects will be discussed briefly afterwards.

Horizontal equity is equity when members of the same group are treated the same (Ecola & Light 2009; Levinson, 2009). These groups can be divided in social, political and economic classes. This means for example that people with the same income will have the same rights. But it can also mean that all people in the same neighbourhood have the right to have the same distance to public facilities (Foth et al 2013). But it can also simply mean that members of a population have the same access to transportation (Welch & Mishra, 2013).

Vertical equity is concerned with differences between groups and occurs when members of the different groups are treated differently. Mostly vertical equity is used to define different income groups and is measured by the ability to pay. Whenever there is a policy where all users have to pay the same amount of money this is a regressive tax, since for low income users this is a bigger proportion of their income in relation to higher income users.

In the literature, horizontal equity and vertical equity are the ones which are used the most (Welch, 2013; Welch & Mishra, 2013; Foth et al, 2013; Litman, 2015). Litman (2015) divides vertical equity in two different forms. The first one is equity with regard to income and social

class. In this definition of vertical equity policies are equitable if they are in favor of socially and economically disadvantaged people, so these are progressive policies.

The other vertical equity definition is with regard to mobility and ability. This definition is more about the service itself than the persons who need the service; it measures to which extent the transportation system meets the need of travellers. This means that travellers with different needs should all be accommodated by the transportation system.

In figure 3 below an example is given of the situation of vertical equity related to the percentage of income spent on transport. This percentage is not divided equally from a vertical equity point of view. Although the lower incomes may pay less for transport, the percentage is almost 3 times higher for people earning less than \$10,000 dollar per year than for those earning more than \$70,000 dollar per year. This means the situation below is regressive, and from a vertical equity point of view all incomes should pay the same percentage on transport.

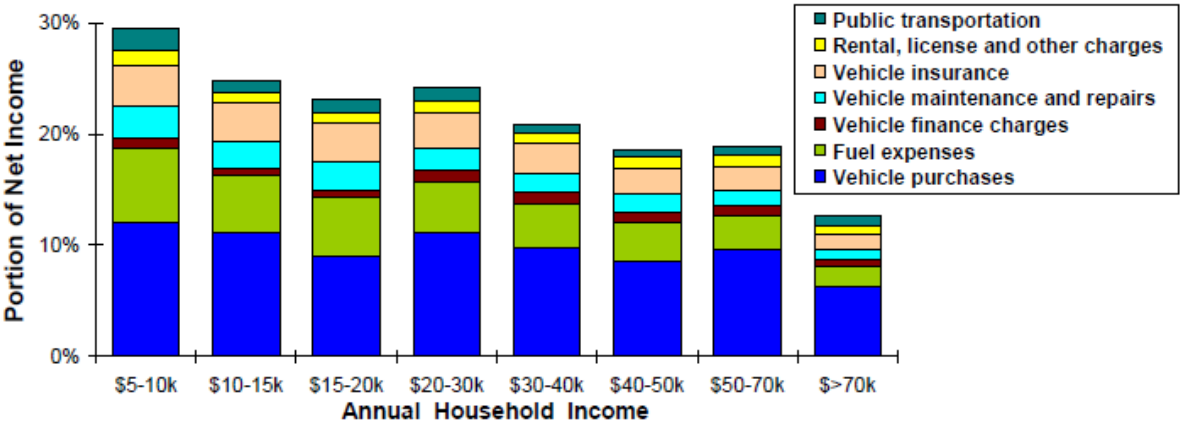


Fig 3. Percentage of income spent on transport in the United States (Litman, 2015)

The other equity aspects

The first two aspects of equity are the most common in the literature, but the others are also relevant in certain contexts. The third aspect of equity is the cost principle, in which the people who contribute to a social cost also have to pay for it. This principle can perfectly be adapted to the concept of congestion pricing, in which a social cost, the congestion costs, will now be paid for by a toll. So this principle is more of a practical concern than the first two aspects.

The benefit principle is kind of similar to the cost principle, where the ones who gain social benefits also pay for them (Ecola & Light, 2009). This concept is also applicable to congestion pricing where drivers benefit when congestion will reduce, but they have to pay for this benefit by using an express lane.

Spatial equity is concerned with the geographic context of the horizontal and vertical equity concepts (Ecola & Light, 2009), which is the case for the case studies which will be discussed in this thesis. Spatial equity implies that people should have an equal accessibility, based on their location. So it deals with the equal distribution of transport facilities over space. The red line extension is for example interesting in this context, to see if it improves an equal distribution.

Social equity is concerned with the question of who needs the infrastructure investments the most? Projects can be equal from a vertical or horizontal equity perspective, but they also need to be built for the people who need these investments the most. As will be discussed in the section about inequality between commuters and downtown residents, public transport projects sometimes serve neighborhoods where most people always go by car. From a social equity perspective, public transport investments should be done in neighborhoods where people depend on public transport.

2.3. Public transport and equity

Geographers have debated for a long time about the relationship between geographical variation and the provision of public transport (Hay, 1993). This relationship is related to differentiation in the welfare of individuals. According to Hay (1993) these effects are most relevant in rural areas. In the urban areas this issue is especially related to the subsidy of public transport. Equity in public transport deals with population, welfare and social equity. Population is in this context associated with subpopulations such as elderly and carless people who depend on public transport, welfare is related to quality of life.

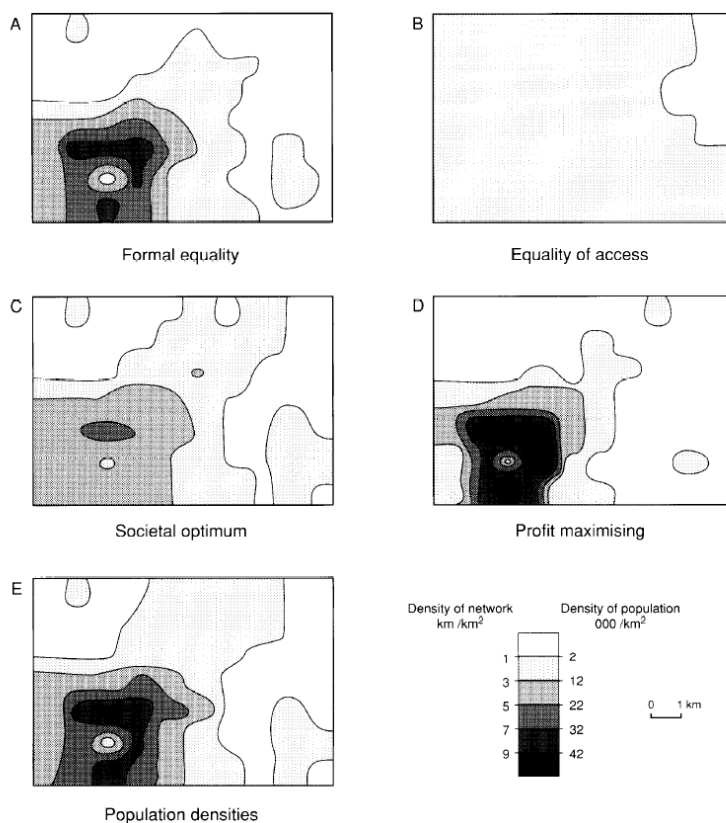


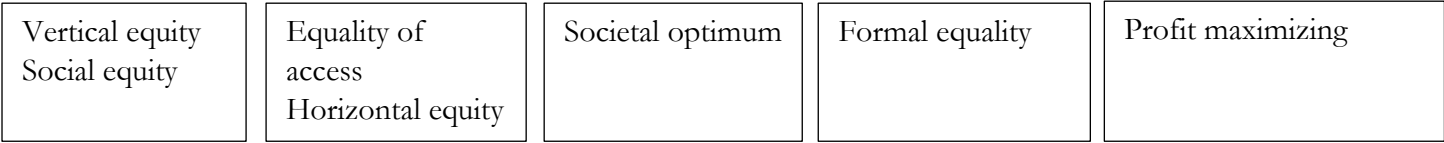
Figure 4. Different options for different interpretations of equity in public transport (Hay, 1993).

Situation A in figure 4 represents the distribution of public transport in a formal equity situation. This means that the public transport is provided in such a way that the availability of public transport depends on the population density, when there live more people in a certain area, more public transport is needed. Situation E represents the population density in the figure above. For this population density different models of public transport can be implemented, of which B and D differ the most. In situation D, the network will profit the most, since there is a bigger demand

for public transport in the areas with higher population densities, which causes higher profits in these areas. In situation B, everyone will have the same options for accessibility. Situation C is a compromise between the two, representing the societal optimum.

This figure above describes equity and public transport in the context of population density, whereas for the different aspects of equity social, economic and political circumstances are the main issues. The figure therefore looks at the equity issue from a different perspective. These different perspectives are somehow linked to each other, which is shown in the following figure.

Levelling ←————→ Regressive



In the figure above is shown how different equity aspects and perspectives are ordered from being a levelling tool towards a regressive tool. When a tool or project is implemented to level a certain situation, this means people without a lot of resources will benefit more than people with a lot of resources. Whenever a tool or project turns out to be regressive, this works the other way around. In this figure, the concepts cost principle and benefit principle have not been included, since these are more of a practical concern than a concept aimed at levelling or being regressive. In the figure above vertical equity and social equity are the tools that level the most, whereas profit maximizing is the most regressive tool. Vertical equity makes sure that people of different income groups are treated differently, in such a way that people with the lowest incomes receive most benefits. Since these people are most of the times the people with the biggest needs, social equity is placed in the same box as vertical equity. Equality of access means the same accessibility for different groups, just like horizontal equity. The societal optimum combines the vertical equity and profit maximizing goals in order to create an optimal outcome for the society. The constraining goals of vertical equity and profit maximizing will be the topic of the next section about inequality between commuters and downtown residents in the United States.

Inequality between the commuters and downtown residents in the United States

Garret and Taylor (1999) discuss the equity of public transport in the USA over the last few decades. In the second half of the 20th century public transport has lost a big market share. This is mainly because of two reasons, because most commuters started to live in suburbs they prefer to travel to downtown by car. A second reason is the massive availability of cars, in combination with public investments in freeways and low fuel prices (Garret and Taylor, 1999). In the chapter about the research context of Chicago it will be shown that most poor people stayed behind in the inner parts of the city. Richer people started to migrate to the suburbs. The effect of this was that the public transport demand in the inner parts of the city was decreasing, leading to less service for the poor people who stayed behind.

In general, there are two big groups who are unable to travel by car, which make up the biggest market groups for public transport. The first are downtown commuters and the other are transit dependent people, who are too old, too poor or simple unable to drive. Transit policies have focused especially on the first group in order to recapture a part of the market share, since the

second group has no other option than to travel with public transport. These policies have been ineffective and expensive (Garret & Taylor, 1999). The second group of people is mainly living in poorer downtown regions and are travelling with buses, in which much less public resources have been invested. So, (Garret & Taylor, 1999) conclude that the current public transport system is not socially equitable and should therefore be revised. The government of the United States has especially invested in expensive rail projects to serve the wealthier suburban commuters (Farmer & Noonan, 2011; Garret & Taylor, 1999), although most people living in these neighbourhoods prefer to travel by car. The poor people who are in real need for public transport investments in downtown buses are being unheard. According to Garret & Taylor (1999) they have not enough economic and political power, which causes an uneven development in public transit services.

Downtown public transport trips account for 69 percent of all public transport trips, while only 20 percent of the people live there (Garret & Taylor, 1999). Other facts which show the segregation between rich and poor public transport networks are that 57 percent of all bus transit users in Los Angeles earn less than 15.000 dollar, whereas the medium earning of a rail commuter is 65.000 dollar. The rail network is being subsidized throughout the country, making it sometimes cheaper to go by train, but the public transit dependent people in the inner city don't have another choice than to pay the full price for the bus. The equity situation has become worse in the United States in the last 50 years from a vertical equity point of view. Since the government has tried especially to invest in large rail infrastructure projects in order to attract new customers, the transit dependent people have no choice other than taking transit. For transit dependent people less profit can be made with the construction of public transport, since these people have to take transit anyway. Because they are not able to shift to another transport mode it doesn't matter for profits if there are investments in public transport or not. Nevertheless, since the early 2000's equity is getting more important (Manaugh et al, 2015).

According to Manaugh & El-Geneidy (2011) the main function of public transport is to provide accessibility to all people, especially to people who are less mobile. This principle of fairness often struggles with the goal of the transit providers: Gaining more money and attract new riders. It is also a struggle between patronage goals and coverage goals. The patronage goal is to attract new people to use the public transport system, so more money is earned. Also there will be less pollution, since there will be less car drivers. The coverage goal is to try to make the public transport accessible for the people who depend on the public transport system and have no other option to travel. These goals make sure a model-mismatch is being created, since there are two different constraining goals for policymakers.

Aspects of equity linked to public transport

Both horizontal and vertical equity are being used in researching equity in public transportation. According to Foth et al (2013) an equitable distribution of transportation benefits implies that first the socially disadvantaged groups should be helped, and only after that the benefits should be maximized for the average. This is a form of vertical equity. But in data analyses horizontal equity is also often used because it treats all households equally (Welch & Mishra, 2013). The term equity planning is a common term in this research field which suggests that planners are responsible for implementing policies and programs that can redistribute public and private resources to the poor and working class (Manaugh & El-Geneidy, 2011). Equity planning is

therefore linked to social and vertical equity, in a way that poor people are compensated when public transport investments are not meeting their needs.

2.4. Measuring equity in public transport

According to Welch & Mishra (2013) there is not one general accepted way to measure equity in public transport. Litman (2015) has studied the data and existing papers on equity in public transportation, and found out that there was a large variation in the measurement of transportation equity. First of all, there is a big difference in measuring horizontal and vertical equity. Also the measurement for one particular equity aspect is often different, since there are a lot of different indicators being used. Manaugh et al. (2015) have done research on the policies of different cities in North America regarding implementing equity in their analyses. They have found a lot of differences between cities, but there are also certain indicators that have been used in many cities. Still, the concept of social equity is pretty much 'intangible', because of the many different ways of measuring equity.

As discussed in the previous section, equity in public transport is not researched in one general way. According to Martens (2012) the discussed equity aspects imply an optimal form of equity, which means that complete equal distribution of transportation facilities is the goal. Since this goal is almost impossible, it is hard to use a certain equity aspect to calculate an equal distribution. Also the differences in natural development of cities mean that in different cities other equity aspects and indicators for equity are relevant. This means that a lot of different measurements are used to address equity. According to Foth et al. (2013) choosing variables to include in a social indicator for equity in public transport is one of the most important aspects. Foth et al (2013) have developed a framework for measuring equity in the public transport system of Toronto, Canada. They have researched the development of equity in the public transport system between 1996 and 2006, in this period several transit projects have been built in Toronto. Foth et al. (2013) have included the following indicators in their data analysis:

- median household income
- percentage of labor force that is unemployed
- percentage of population that has immigrated within the last 5 years
- percentage of households that spend more than 30% of income on housing rent.

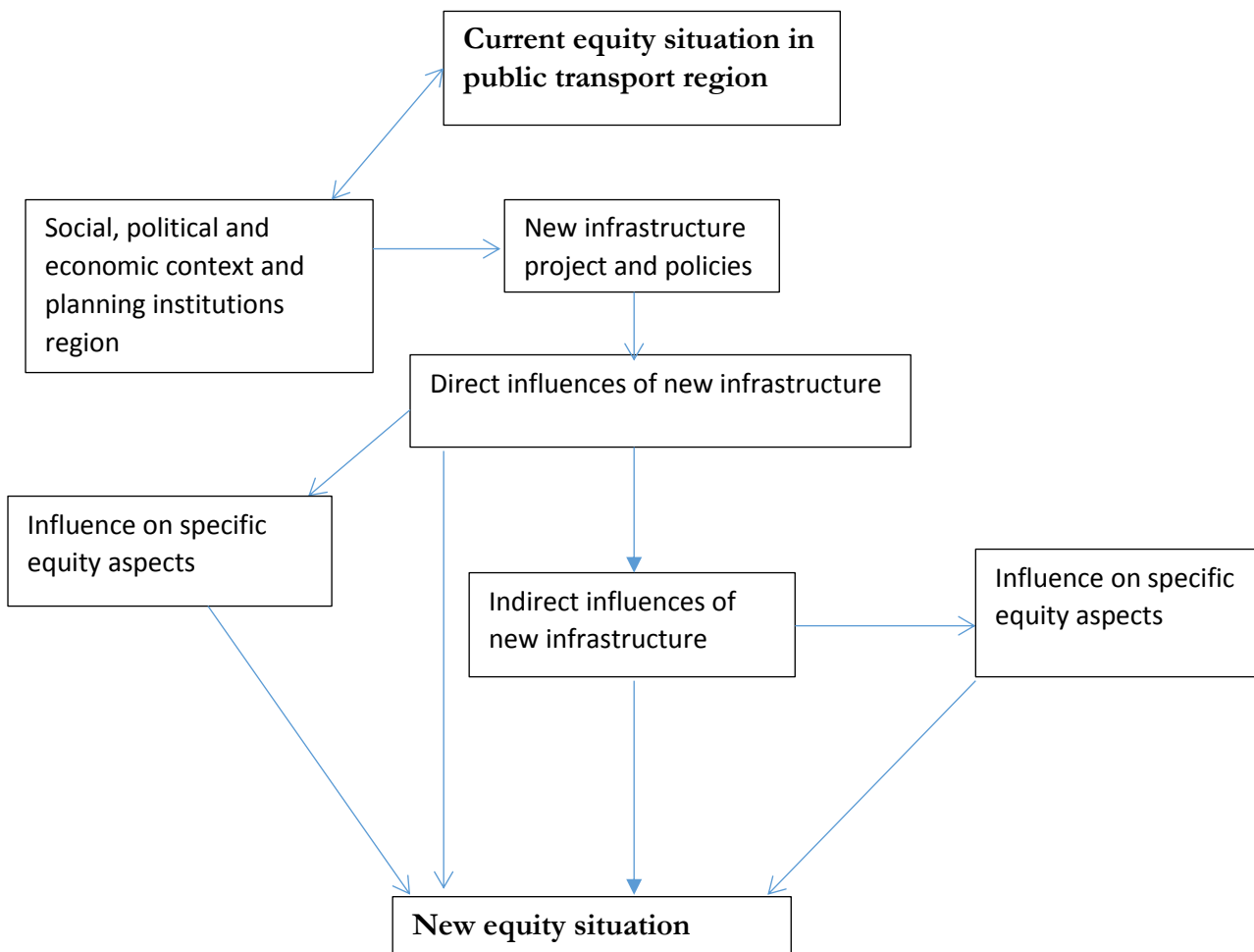
Some of these variables are very common, like the median household income, others are very specific for this case. For example the percentage of the population that has immigrated within in the last 5 years. Since this is the case of Canada which has very strict immigration rules, this factor can be a really good indicator. The other indicators besides social indicators that Foth et al. (2013) have used are transit travel time and job accessibility. Travel time and accessibility are indicators which are often used in this kind of research. Manaugh et al. (2015) also found that these are indicators which are used a lot to address equity in big North American cities.

Welch & Mishra (2013) have developed a similar framework as Foth et al. (2013) to measure equity effects in public transport in the Baltimore-Washington region. They have used the transit catchment, accessibility, the inequality index (Gini-index) and connectivity in their framework.

2.5. Social Justice

In the field of social justice not a lot of attention has been paid to the role of transportation (Martens et al 2012). According to Beyazit (2011) social justice is the distribution of what is owned, gained and lost by the members of a society. Social justice or injustice can be interpreted as a deviation from equality (Martens et al, 2012). Investments in highways are mostly done where demand exceeds the capacity of the roads or they are projected on forecasted travel. When a traveller is making more use of the road, this traveller will make more use of the benefits which investments in the roads provide. Since automobile-based mobility is strongly focused on city to suburban travel (Martens et al 2012), citizens who live in suburbs will have more benefits. Since low-income people have stayed behind in the city centre because of social processes, they will have less benefits from these investments. According to Martens et al. (2012) there is a spatial mismatch in this concept, this is not only the case for car traffic, but also for public transportation systems. Martens & Golub (2014) state that a plan is more fair if the access by car and public transport is more equitable for the majority of the population. Beyazit (2011) states that social justice issues have to be researched as a process and should not be interpreted just as consequences for individuals.

2.6. Conceptual model of the theoretical background



Explanation of the model

In the model on page 17 the first conceptual model of this thesis is presented, in total 3 models are included in this thesis. They all have the same basic structure, and every next model provides more details. In this model it can be seen how a new infrastructure project or policy creates a new equity situation. These projects depend on the social, political and economic context of the region and on the institutions of the region. In the theoretical background it is argued that there is inequity between commuters and downtown residents in the United States. This is an example of a social and economic context which can be the reason to invest in new infrastructure projects or policies. Also planning institutions, like CMAP in Chicago, play an important role in building new infrastructure. These new projects have direct and indirect influences. These influences then influence the equity aspects, which have been discussed in the theoretical background. In this way a new equity situation in the public transport system will be created.

2.7. Key concepts of the theoretical background

In this theoretical background the main topics included equity, public transportation and social justice. Although social justice issues are not part of the research questions for this thesis, the concept is very closely linked to equity in public transport and therefore included in this theoretical background. The connection between these three different topics was a key element in this theoretical background. For example, investments in public transport have a different outcome for different kinds of equity and for different measurements of equity. It is shown that it is difficult to incorporate different goals in transportation policies, in order to achieve social justice for all income groups. And therefore it is also hard to create horizontal and vertical equity with the same project. There are often constraining preferences for downtown commuters and transit-dependent people. This theoretical background will be the base for the remainder of the thesis. For example the different indicators which are relevant for the case studies, are discussed.

Chapter 3 Methodology

3.1. Introduction

The main focus of this thesis consists of two case studies, the red line extension on the south side of Chicago and the equity impacts of congestion pricing in Chicago. So, first the case study approach will be discussed in this methodology. After this, the methodology about how to address these case studies is discussed. The methodology for the literature review, the data analysis and the interviews are presented separately. One part of the data analysis is used to address the equity situation in the public transport system of Chicago in general. The case of the red line extension is also researched with a data analysis. The goal of the interviews and the data analysis is discussed, and the link will be made with the theoretical background. Finally ethical issues regarding the interviews are explained.

3.2. Case study analysis

In this thesis a case study approach is used as the main instrument to address the topic of equity in the transportation planning of Chicago. As discussed, the two cases are the red line extension to the far south side and the implementation of congestion pricing. Since the research is only investigated in Chicago, it can be argued that researching equity in the public transport system of Chicago is a case itself. On the other hand, with the two case studies in this thesis a more in-depth analysis of two projects is provided, whereas the case of Chicago is the context of these projects. So, the two cases of the red line extension and congestion pricing considered the two real cases of this thesis, and the analysis for Chicago is the context for these two projects. When studying the equity of public transport in Chicago there are a lot of different aspects that influence this equity, which makes it hard to get a detailed view of all these aspects. When two relevant cases are chosen which will be researched more in-depth this gives a chance to elaborate more on these two particular cases, which gives the chance to state a more adequate hypothesis.

A case study is an important method in social sciences to research a certain phenomenon. Simons (2009) defines a case study as:

[...] Case study is an in-depth exploration from multiple perspectives of the complexity and uniqueness of a particular project, policy, institution, program or system in a “real life” context.

As Flyvbjerg (2006) argues the case study is a necessary and sufficient method for certain important research tasks in the social sciences. Thomas (2011) states that within a case study there is a distinction between the object of study itself and the analytical frame and theories through which the object is studied. In this thesis this has been done by dividing these parts in different chapters. In the case of equity of public transport it is very difficult to study the topic in general without specifying on certain cases. When a few cases will be studied in depth the case study is an important methodological approach. The case study is argued to be less applicable to give a generalized conclusion of a certain phenomenon, but according to Flyvbjerg (2006) it is per definition hard to draw general conclusions in social sciences, and case studies can definitely be useful to test or generate hypotheses.

3.3. Research steps and methods

As mentioned in the introduction, for the different parts of the thesis different research methods have been used. These will be discussed in the remaining part of the methodology. First, a short overview of the used research steps and methods is provided. For the equity situation of Chicago at the moment literature has been used, which is presented in the case description chapter. Also, experts have been interviewed about this topic and this part is adopted in the data analysis as well. For the red line extension, the data analysis is important to measure the impact of the extension. Also a literature review has been conducted, which is adopted in chapter 5. The interviews for the red line extension are mainly discussed in chapter 6, the results. For the congestion pricing case study, only a literature review has been used and interviews have been conducted. These are used in chapter 5 and 6.

3.4. Literature review for the two case studies and the context of Chicago

For the two case studies the equity impact of two transport investments in Chicago will be analysed, the red line extension and congestion pricing. For both cases a literature review has been executed. For both projects policy documents have been used to describe the background and implementation of the projects. In these documents also goals of the projects have been listed. The feasibility of these goals has been tested with the data analysis and interviews. There is some literature about the red line extension project and also a lot of debate about the implementation which is important to understand the context of the project. For the congestion pricing part, the literature is an important way to get a general background of equity linked to congestion pricing.

There is a lot of literature available about the history of equity in public transport in Chicago and also about the current situation of the Chicago public transport system. Also there is literature about indicators to use for measuring equity in public transport which is very useful. This is a good starting point for some questions for the interviews and to shape an image of the public transport situation in Chicago in general. In the scientific literature there is a big debate about the different aspects of equity. The goal is to see how aspects of equity are influenced by new infrastructure investments. The aspects of equity are horizontal and vertical equity and the indicators can be things like accessibility and income. These indicators for equity can be variables like accessibility, commuter times, opportunities and income segregation.

3.5. Data Analysis

A quantitative data analysis has been used in this thesis to visualize the equity situation in Chicago and to measure the influence of the red line extension. The dataset for this thesis comes from the website www.city-data.com. This dataset provides information about a lot of potential indicators for equity in public transport. In this dataset there is information about income, time to work, population density, distance to city centre, transport mode to work, amount of cars per household for all zip codes in Chicago. Also, there might be indicators that are not already in this dataset. The indicators that are used for the analysis depend on what experts think are important indicators. There are also other datasets available from all CTA stops in Chicago by the City of Chicago (2016). The results of this analysis can be shown in GIS to have a clear view of the current equity situation in Chicago and the influence of the red line extension.

The dataset from citydata.com has been manually imported into Microsoft Excel. Part of this Microsoft Excel file is shown in the appendix of this thesis. This data had to be adjusted into the

right form in order to be able to use it in GIS. In GIS several datasets have been put together in order to create the eventual maps. One of these datasets is a file with all the zip codes of Chicago linked to all coordinates. This was useful since the zip codes in the citydata.com file were not linked to specific coordinates. Because the zip code file did contain these coordinates, these files could be joined in order to create a specific zip code map of Chicago and Cook County. These two specific regions have been chosen, because the effect of the red line extension isn't limited to the city limits of Chicago (CMAP, 2012), so the suburbs of Cook County are included. Also, data from the CTA rail lines has been adopted in the maps to see the current rail lines of the CTA system in Chicago. The execution of the data analysis is explained in the results, since the execution depends on the indicators which are used. These indicators are presented in the results.

The goal of the data analysis is to get the obtained answers for the research questions in combination with the background knowledge, which comes from the interviews and the literature. With the data analysis a clear view from the equity situation can be shown in GIS, so the current situation becomes visible, just as the equity effects from the investment in the red line extension.

3.6. Interviews

For this thesis interviews with nine experts have been conducted. Since the thesis is divided in different parts, all experts have been interviewed on the topic of their expertise. Since interviews have been conducted on different topics, there are also different goals for these interviews. There are three main goals for the interviews that have been conducted in thesis. These goals are:

- Getting a better background information on certain topics current equity situation, implementing congestion pricing and the red line extension.
- Providing critical information about measuring equity in public transport and especially about the indicators to measure equity.
- Opinions about the current equity situation, implementing congestion pricing and the red line extension.

Since all interviewees have different views on these topics it is interesting to analyse these different opinions. The interviews will be the key element for the results of this thesis and the data analysis will be used as a helpful tool on top of the interviews. It is important to hear the view of experts about what indicators should be included for the different aspects of equity. The interviews will help to understand the context of the project of the red line extension. The view of the experts on this topic, whether it is a good investment and what according to them the equity effects are, is also important. The question whether the red line extension is a good investment is not only questioned in regard of a growing mobility for people in the region, but also regarding more economic development in the region.

Also interviews have been conducted with experts on the topic of congestion pricing to hear their view about the equity effects of congestion pricing. The interviews have been conducted with researchers as well as policymakers on the topic of congestion pricing. These interviews will be analysed together with the literature in order to get a comprehensive view of the equity implications of implementing congestion pricing in the city of Chicago.

The following persons have been interviewed for this thesis; the goal of the interviews is mentioned as well.

Date	Person	Organization	Goal
02/02/2016	Tom Murtha	CMAP	Information and opinion on congestion pricing
02/23/2016	Stephanie Farmer	Roosevelt University	Information and opinion about equity situation in Chicago and red line extension
03/16/2016	Kevin Manaugh	McGill University Montreal	Opinion about theories and measuring equity
03/17/2016	P.S. Sriraj	University of Illinois Chicago	Information and opinion about equity situation in Chicago, red line extension and congestion pricing
03/18/2016	Tim Welch	Georgia Institute of Technology	Opinion about theories and measuring equity
04/14/2016	Sonali Tandon	Chicago Transit Authority	Information about red line extension
04/18/2016	Jacquelyn Murdock	CMAP	Information and opinion about equity situation in Chicago, red line extension and congestion pricing
04/18/2016	Claire Bozic	CMAP	Information and opinion about equity situation in Chicago, red line extension and congestion pricing
04/18/2016	Jacky Grimshaw	Center for Neighborhood Technology	Information and opinion about equity situation in Chicago, red line extension and congestion pricing

Ethical issues regarding interviews

The interviews which have been conducted for this thesis are for one part in person interviews, but also telephone/skype interviews have been used. Especially for the people who live further away it was not possible to arrange in person interviews. This was for example the case with Kevin Manaugh from Montreal and Tim Welch from Atlanta. All persons have been asked whether it was permitted to record the interview. Most of the interviewees gave permission to record the interview, only Sonali Tandon from the CTA (Chicago Transit Authority) didn't want to have the interview recorded. In total, 6 of the interviews were in person interviews and 3 interviews were telephone or skype interviews. Bloom & Craptree (2006) divide four ethical issues regarding interviews:

According to Bloom & Craptree (2006) there are four ethical issues regarding interviews:

- To reduce the risk of unanticipated harm
- To protect the interviewee's information
- Informing the interviewee about the nature of the study
- Reducing the risk of exploitation

For this thesis these ethical issues have been respected. The information from the interviews has not been used for other purposes than this thesis.

Chapter 4 Case Description

4.1. Introduction

In this chapter the context of Chicago regarding equity in the public transport system will be discussed. Important concepts in this context of Chicago are segregation and suburbanization. Also the public transport system of Chicago will be discussed in this chapter, which will be linked to some issues from the theoretical background. This chapter will be a link between the theoretical background and the case studies from Chicago, which will be discussed in the next chapter.

In Chicago processes of suburbanization and segregation have played an important role in the socio-economic context in the city for the past 50 years. Suburbanization is defined by Denton & Messey (1988) as:

A political creation brought about by the division of urban space into mutually exclusive units of local government.

Based on data from the article of Denton and Messey out of 1988, Chicago is the city with the highest segregation based on differences between white and black people living in the central city compared to the suburban areas. This fact shows the link between segregation and suburbanization. Many middle and high class white Americans started to leave the cities to live in the suburbs, which started the process of suburbanization in the 1950s (Denton & Messey, 1988). On the other hand low class black people stayed behind in the city center which meant segregation between rich and poor and black and white people was rising (Denton & Messey, 1988).

4.2. Segregation in Chicago

Segregation can take place on the base of several factors, such as income and race. Segregation is a major issue in the city of Chicago, which can be seen in the following two figures. In figure 5, the red line train is visualized in a map where the ratio of African Americans is shown in Chicago. It can be seen that this number is way higher along the south side of the red line than on the north side of the red line. The most neighborhoods on the south side of Chicago have a population of more than 75 percent African American inhabitants, whereas on the north side of the train line this percentage is less than 20. Also on the proposed area of implementation of the red line extension, the level of African Americans is over 75 percent. These facts mark that segregation is a major issue in Chicago. Segregation is because of these facts also important in relation to equity. According to the vertical equity principle the people in these poor neighborhoods should have better access to public transport than people from richer areas in the suburbs. Also for the two cases of congestion pricing and the red line extension, segregation is a major influence. As will be discussed more extensively in the case study, segregation can mean that there will be less demand for congestion pricing in poor areas. The area of the red line extension is a region with a lot of low income people, as it is an area in the south side of Chicago, which has become the poorest region of Chicago, due to processes of segregation and suburbanization.

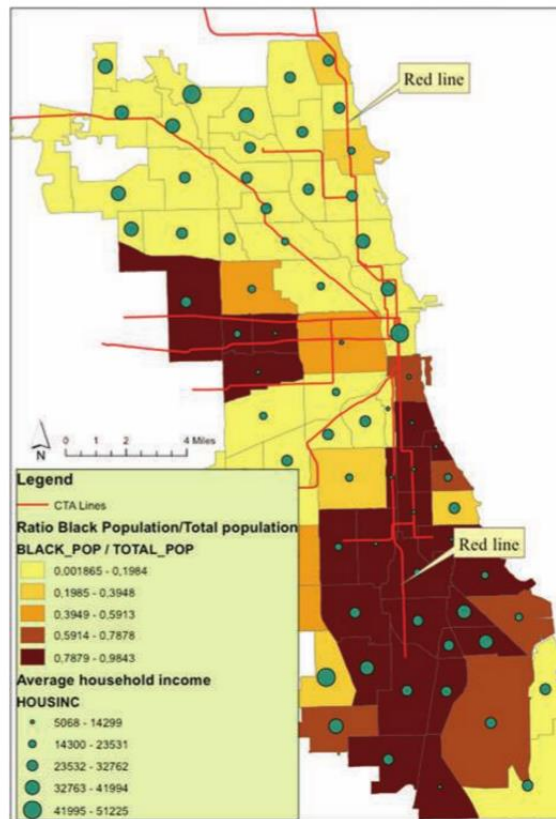


Figure 5. Segregation in Chicago on the base of differences in race (Snyngedown, 2013)

Another important factor on which segregation can be based is income. Figure 6 shows the difference in this income segregation between 1970 and 2012, which has risen all over the city. In 1970 some neighborhoods on the north side of the city were richer than the average and there were some poor neighborhoods on the south and west side. Since 1970 this income segregation has grown dramatically, now there are a lot of neighborhoods where the median income is less than 45% of the median income of the city of Chicago.

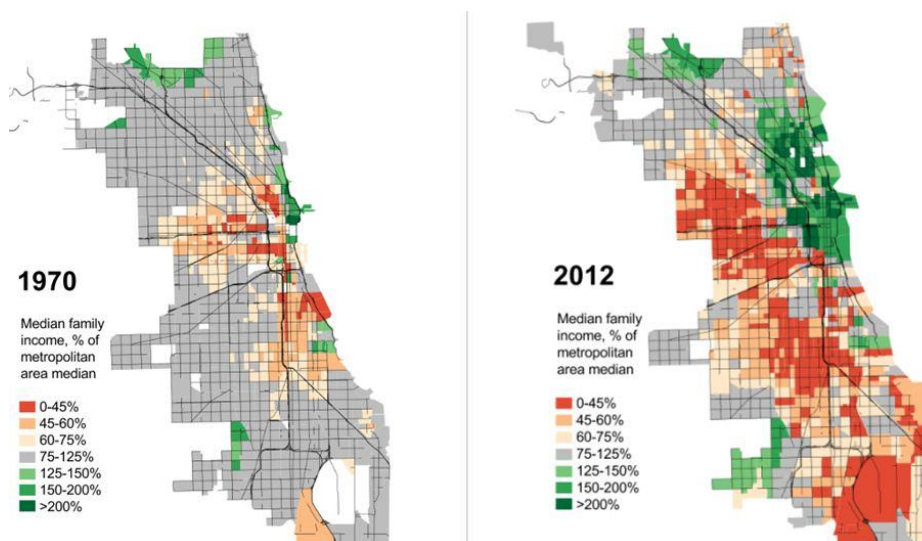


Figure 6. The income segregation in Chicago in 1970 and 2012 (University of Chicago, 2016).

4.3. Public transport in Chicago

Farmer (2011) has researched the developments of public transport in the city of Chicago of the last fifty years. In the first part of the 20th century the public transport system grew rapidly, contributing to the fact that Chicago is the third-largest city in the USA today (Farmer, 2011). At the moment the city has second-largest public transport system. In 1945 the Chicago Transit Authority was founded, after several private organizations consolidated into this agency. Around fifty percent of the profit of the CTA comes from rider fares (Farmer, 2011). The city of Chicago faced population decline due to suburbanization between 1960 and 1980, which caused a decline in the revenues from rider fares, since more people started to use the car (Farmer 2016, interview). After this period, the focus of the CTA was more on elevating the global city image. Because the focus of the CTA changed, projects like the Central Area Plan and the Airport Express Service were initiated. With this line the airport could be integrated into the economic core of the city, but eventually it didn't come off the ground (Farmer, interview 2016). Around the year 2000, the CTA started to face financial difficulties (Farmer & Noonan, 2014). In the late 2000s this process started to change. People started to move back to the city from the suburbs, leading to more interest in the public transit system again (Farmer, interview 2016). For this reason there are more investments again in the system. However there is a debate about how this money should be spent. The CTA is trying to get federal funds for several projects, now that transit investments are feasible again. These new investments are another point of debate, since the CTA is struggling whether to invest in transit that creates global development or transit that helps transit dependent people.

As discussed in the previous section, the CTA has invested especially in core projects in the last decades, and these investments were especially made in the central area and in the direction of the airports (Farmer, 2011). The developments are especially focused on staying globally connected, because of the express services to the airports directly to the airports, bypassing the other stations on the lines to O'Hare airport and Midway airport (Farmer, 2011). Development in the poorer neighborhoods, like the red line extension which will be discussed in the next section, are not yet in the phase of being implemented (Farmer, 2011). Because of the issue of segregation of Chicago, with many poor people in the south and west side depending on public transport, there is an uneven development in the transit system at the moment.

4.4. Transit Oriented Development

Transit oriented development is also an important factor, when it comes to equity in public transport. Transit oriented development happens due to investments in areas close to public transport stations. This means rent prices go up, which makes it unaffordable for lower income people to keep paying the rents (Grimshaw, interview 2016). At this point richer people move in to these places. Transit oriented development takes place at this moment especially in the areas of Chicago along older rail lines, which are located closer to the city center. One example of this is Logan Square along the blue line of Chicago. This is an effect that takes decades, and therefore takes place at stations that already exist for a while. Therefore this is not an immediate threat for the red line extension, Grimshaw argues. This is because the area around the red line extension is further away from current transit oriented development areas and because the metro line is not yet build. Although transit oriented development could become a problem in the long run.

Chapter 5 Case studies

5.1. Introduction

In the case study section the cases of the red line extension and congestion pricing will be discussed. The cases are structured in a similar way in this section. The only difference is that for the congestion pricing section the concept of congestion pricing is first explained. In the chapter about the data analyses the cases will be discussed as well, even though then they will be discussed in a different way, because of a different methodology which is being used, which is already discussed in the methodology chapter. The structure of this chapter is in both cases to first introduce the cases, then describe the background of the project, after this the proposed way of implementation will be discussed and as last the role of the project in regard of equity.

5.2. Red line extension

The red line extension is a proposed railroad project in the far south side of Chicago, running from 95th street to 130th street. The project will be implemented in a very segregated area of Chicago where a lot of black people live (Raudenbush, 2012; Swyngedouw, 2013).

In the current situation, the far south side of Chicago is a very segregated area, both when it comes to race and income (Raudenbush, 2012; Swyngedouw, 2013; University of Chicago, 2016). The project has been in the planning documents since 1949 (Tandon, interview 2016). In the 1960s the CTA began building the red line with the intention to build the line until 130th street, eventually the line was only build until 95th street (Farmer, 2011). In 1969, the decision was made not to build the line all the way to 130th street although the majority of the rail line is already built. The project has been postponed to 2006, the reason for this was that there was no money to invest in new rail lines. The neighborhood turned into a strongly segregated African-American community (Farmer, 2011). In the decades after the 1960s the focus of the CTA was more on facilitating projects in the economic core, as discussed in the research context chapter. In the 1990s there even was a federal law to restrict building new rail infrastructure (Tandon, interview 2016). When the planning process started again in 2006, first alternative routes have been proposed. One alternative was to build the extension along the Halsted street corridor, which is a street with a lot of commercial activities, but this has eventually been rejected due to a lack of public interest in the alignment. Now the red line extension has been adopted in the CMAP Go To 2040 plan, and it is in the physically constraint list of projects (Sriraj, interview 2016). This puts the red line extension in a good position, because this means the project will be prioritized by various stakeholders. It also gives the project a bigger chance to obtain federal funding. In order to get this federal funding the CTA has to prove all the goals of the project are met and that the region benefits from the project (Sriraj, interview 2016). At this moment, the costs for the project are estimated to cost way more, 1,7 billion dollars (Addie, 2013). The current average commute times for Chicago residents are shown in figure 7, as can be seen the average commuting times for neighborhoods close to the proposed red line extension are at the moment way higher than the Chicago average.

The federal funding might be reduced, because of population decline in the area of the project (Tandon, 2016 interview). Besides the federal funding, the city of Chicago also has to pay around one half of the total costs of the project. According to Farmer (interview, 2016) the CTA prioritizes other projects than the red line extension. For the funding from the city of Chicago it comes again to the debate where there should be invested in projects as part of the economic development of the city or to provide transit as a social good. Finally, the project can be completed with a public-private partnership, but a disadvantage of this strategy is that the private investor often has constraining goals (Farmer, interview 2016).

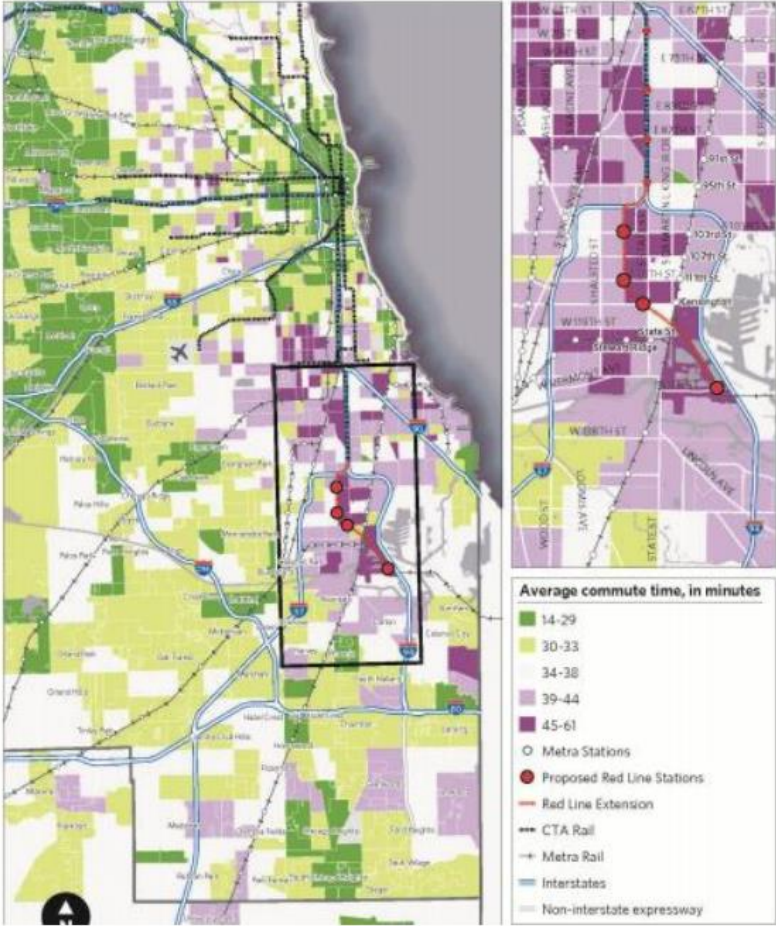


Figure 7: Average commuting times in different Chicago neighborhoods (CMAP, 2012).

Proposed way of implementation

As discussed, the proposed way to implement the red line extension is from 95th street until 130th street in an area with over 95% black people and where 22% of the people don't have a car (Farmer, 2011). In one part where the project will be implemented there isn't even a CTA (Chicago Transit Authority) bus service at the moment. At this moment the Developing Communities Project is trying to convince the CTA to let the project go on with different kinds of campaigns with the main goal to be federally funded. In 2009 the CTA started to prioritize the project. Also, the CMAP has written a report about the need of the project (CMAP, 2012). As can be seen in figure 8, there will be 4 new stations added to the red line. Although the exact route of the line is not clear yet, a big part of the line will be built along existing rails.

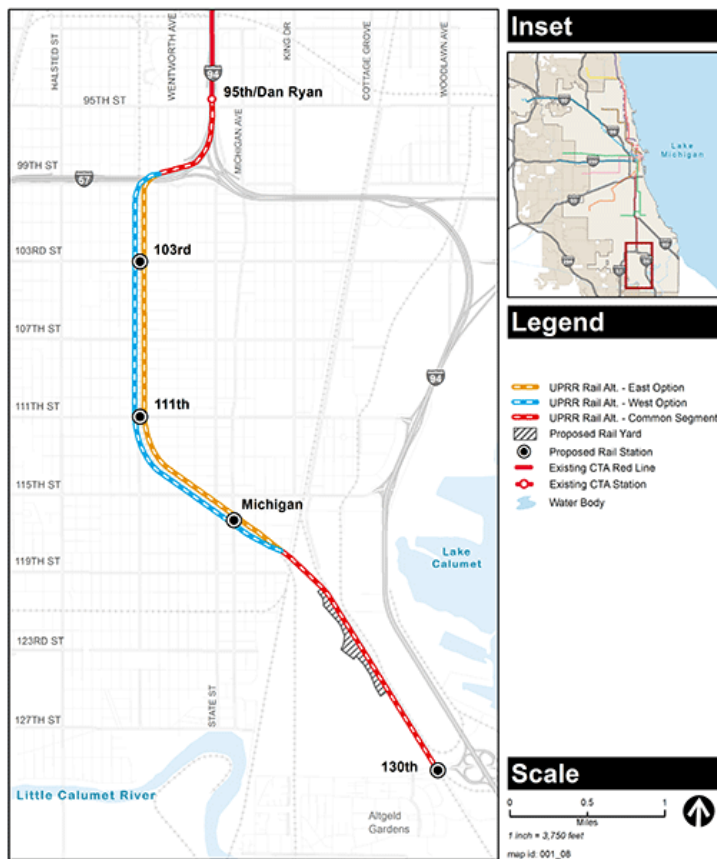


Figure 8. The red line extension with the proposed stations (CTA, 2016).

Main objectives for implementation regarding equity

The CTA has listed the purposes of the red line extension on their website (CTA, 2016). These goals are:

- Reduce the commute times for residents both within and south of the project area.
- Improve the mobility and accessibility for transit-dependent residents in the project area.
- Improve rapid transit rail service to isolated areas and provide viable linkages between affordable housing projects, jobs, services, and educational opportunities.
- Provide an opportunity for potential connections and linkages to other public transportation modes, including regional commuter rail in the project area.
- Create economic development in the project area, where new stations may serve as catalysts for neighborhood revitalization and help reverse decades of disinvestment in local business districts.

The CTA (2016) acknowledges that disinvestment in public transport has had a negative impact on the neighborhoods close to the proposed project location. Problems according to the CTA include longer commuter times and limited rail accessibility which has caused the isolation from major activity centers. The CMAP (2012) has also researched the impact of the red line extension. The CMAP has predicted that the impact of the red line extension will especially improve the accessibility for job opportunities, educational institutions and health facilities. The red line extension can also benefit bus-to-rail connections south of 95th street. After implementation of the project buses can connect the area south of 130th street to this railway station. The last main benefit of the project according to the CMAP is the positive economic impulse, which is certainly necessary in the neighborhood. For these reasons the CMAP recommends the building of the

project. The CMAP (2012) has visualized the travel time savings for downtown commuters because of this project in a table, which is shown in figure 9. It can be seen that the downtown commuting time to Jackson station will be reduced by more than 20 minutes.

Travel Time Elements	No Build (current travel times - minutes)	Locally Preferred Alternative (minutes)
Wait time at 130 th Station	3.50	2.25
Run time 130 th to 95 th Stations	28.00	14.00
Walk time: curb to platform	3.00	0.0
Wait time at 95 th Station	2.25	0.0
Run time 95 th to Jackson Station	25.00	25.00
Total Travel Time	61.75	41.25

Fig. 9. Travel time savings due to the construction of the red line extension (CMAP, 2012).

As can be seen in figure 10, the red line extension is important as a connection to the job centers which are mostly located in the downtown area and around the O’Hare and Midway airports. There are also some smaller job centers in the neighborhood of the new train line.

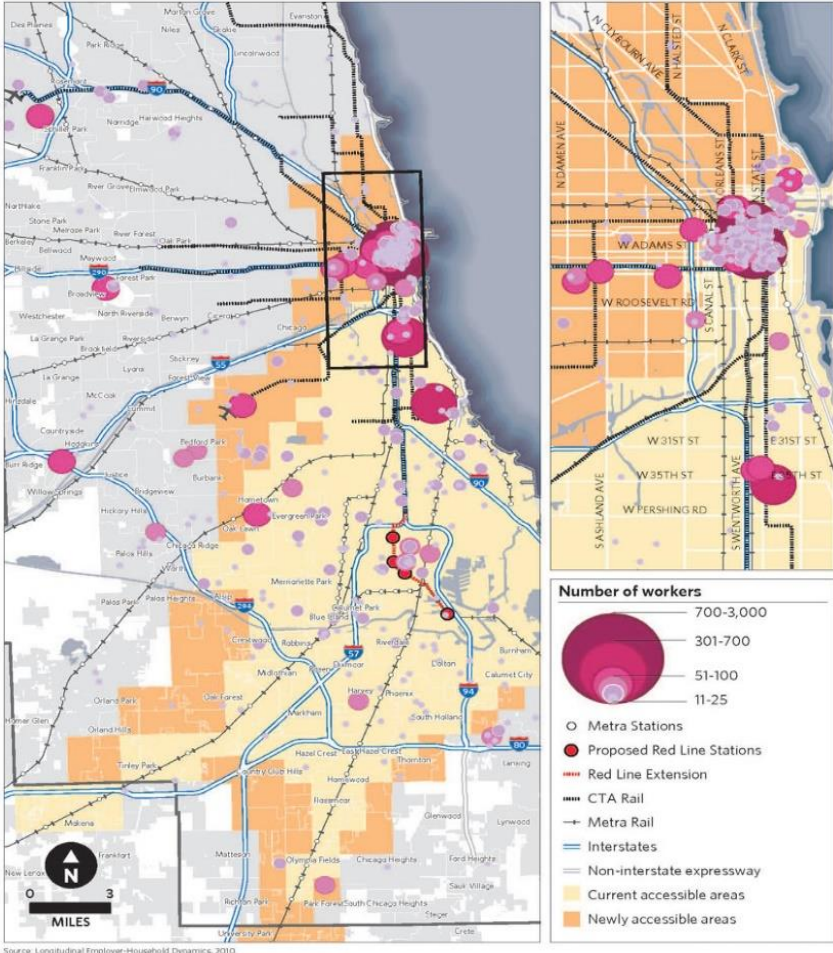


Fig 10. Job centers in Chicago in relation to the red line extension (CMAP, 2012).

The purposes and objectives of the CMAP and CTA of building the red line extension are in line with the theories about equity and public transport, especially from a vertical equity point of view. As Foth et al (2013) state, an equitable distribution of transportation benefits implies that first the socially disadvantaged groups should be helped, and only after that the benefits should be maximized for the average, which is a form of vertical equity. The purpose of this project is that it will benefit a socially disadvantaged group of people by reducing travel times and improving accessibility.

5.3. Congestion pricing

Congestion pricing can make sure the costs which exist because of congestion are covered. These congestion costs are the costs that exist because every extra traveler causes more congestion, which creates delays for others. This delay is measured in time, and with the value of time the total congestion costs can be calculated. When there is congestion, drivers do not pay the full marginal social cost of their trips. This means there is a situation in which it is beneficial for an individual to travel, but this has a negative influence on the society, in this way a negative externality is created (de Palma & Lindsey, 2011). Congestion pricing can be introduced to cover this externality. Congestion pricing works through supply and demand (Chicago Metropolitan Agency for Planning, 2010). When there is more demand for an express lane, the price will rise. The Federal Highway Administration (2008) states that congestion pricing causes that congestion will decrease because it becomes more attractive for travelers to travel during off-peak periods. In this way people will choose to travel at off-peak periods or with a different mode of transportation, so the highway system will be less congested.

Different forms of express lanes

Almost all American congestion pricing projects are a facility-based scheme. There are three main different forms to implement facility-based schemes: HOT lanes (High-Occupancy Toll lanes), HOV lanes (High-Occupancy Vehicle lanes) and schemes where all drivers have to pay (US Department of Transportation, 2015). In the scheme where all cars have to pay, all cars are allowed. For the high-occupancy vehicles (HOVs) there is the same rate as the single-occupancy vehicles (SOVs). In an HOT-lane all vehicles can use the express lanes, but the HOVs can use the facility for free, whereas SOVs have to pay a toll (De Palma & Lindsey, 2011). In an HOV-lane only high-occupancy vehicles are allowed. In figure 11, the congestion pricing outcome according to CMAP is presented.

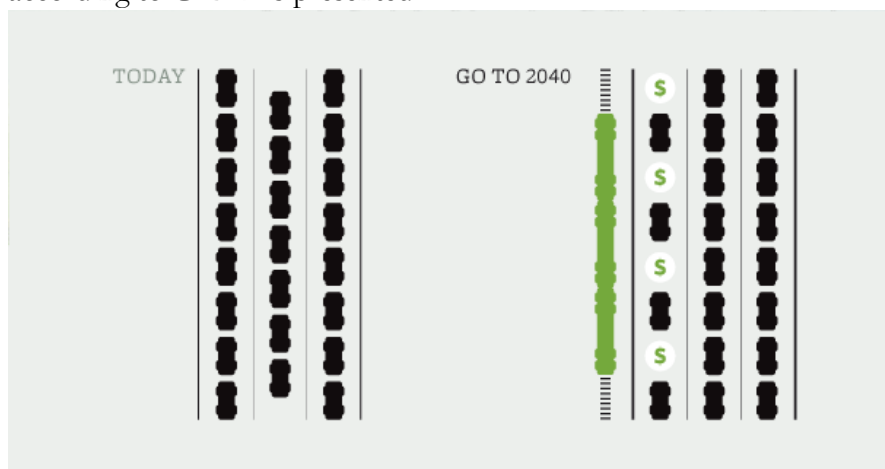


Fig 11. The outcome of the congestion pricing system. (Chicago Metropolitan Agency for Planning, 2010)

Proposal for Chicago

At the moment the gas taxes, vehicle registration fees and tolls are just about enough to cover the costs of resurfacing and reconstruction in Chicago. This means drivers do not pay for other road costs, like congestion costs. This is one of the main reasons that CMAP has proposed to implement congestion pricing. The CMAP came with a proposal to implement congestion pricing on five different highways in Chicago in 2012. These highways are: The Stevenson Expressway (I-55), Jane Addams Memorial Tollway (I-90), Elgin O' Hare expressway, Eisenhower Expressway (I-290), and the IL-53. The CMAP aims to implement congestion pricing only on highways which are currently under construction, in a sense that extra lanes will be added. These five highways would be expanded anyway, so congestion pricing was proposed as an addition to the current projects. These five highways are shown in figure 12. CMAP concluded that after the adding of this extra capacity, it was not needed anymore to implement congestion pricing on all the highways. Because of this extra capacity there is now enough supply of free-flow traffic conditions on all the highways, except for the Stevenson Expressway (I-55) and the Eisenhower Expressway (I-290).



Figure 12. The five proposed locations of implementing congestion pricing in 2012 (CMAP, 2012 (2))

These two proposed highways are not the most congested roads in the Chicago region, but the most congested roads which will be expanded (CMAP 2016, interview). The implementation of congestion pricing is a recommendation of the CMAP and so it is not completely sure yet if it is going to happen. The proposal for congestion pricing consists at the moment of an express lane on the Stevenson Expressway (I-55). When this project succeeds and is widely accepted by the people in Chicago, there will probably be more highways where congestion pricing might be implemented so a network of congestion pricing facilities can be created (CMAP 2016, interview).

Main implications of implementation regarding equity

According to the Chicago Metropolitan Agency for Planning (2010) there are two important pitfalls regarding the implementation of congestion pricing. One of them is very important for this thesis, the potential regressivity, since low income people might not be able to pay for a premium lane. The Chicago Metropolitan Agency for Planning is aware of the fact that congestion pricing can make some people worse off than others and thinks it is important to ameliorate these pitfalls. The other pitfall is related to the revenues of the congestion pricing system and how they will be spent. In this case equity is also an important issue, since the revenues can be used in a way to make the system more equal.

According (Bonsall & Kelly, 2005) low-income people are most at risk when congestion pricing is implemented. Some people might be car-captive, because now there is an alternative for some particular journeys, other than driving by car. Walking or bicycling might be too far and public transport might be inaccessible in the place they live. Lloyd-Jones & Rakodi (2002) state it is of critical importance for the urban poor to have affordable transport to the city center, in order to widen their employment opportunities. When it is not possible for them to travel to the city center for their job they will be socially excluded.

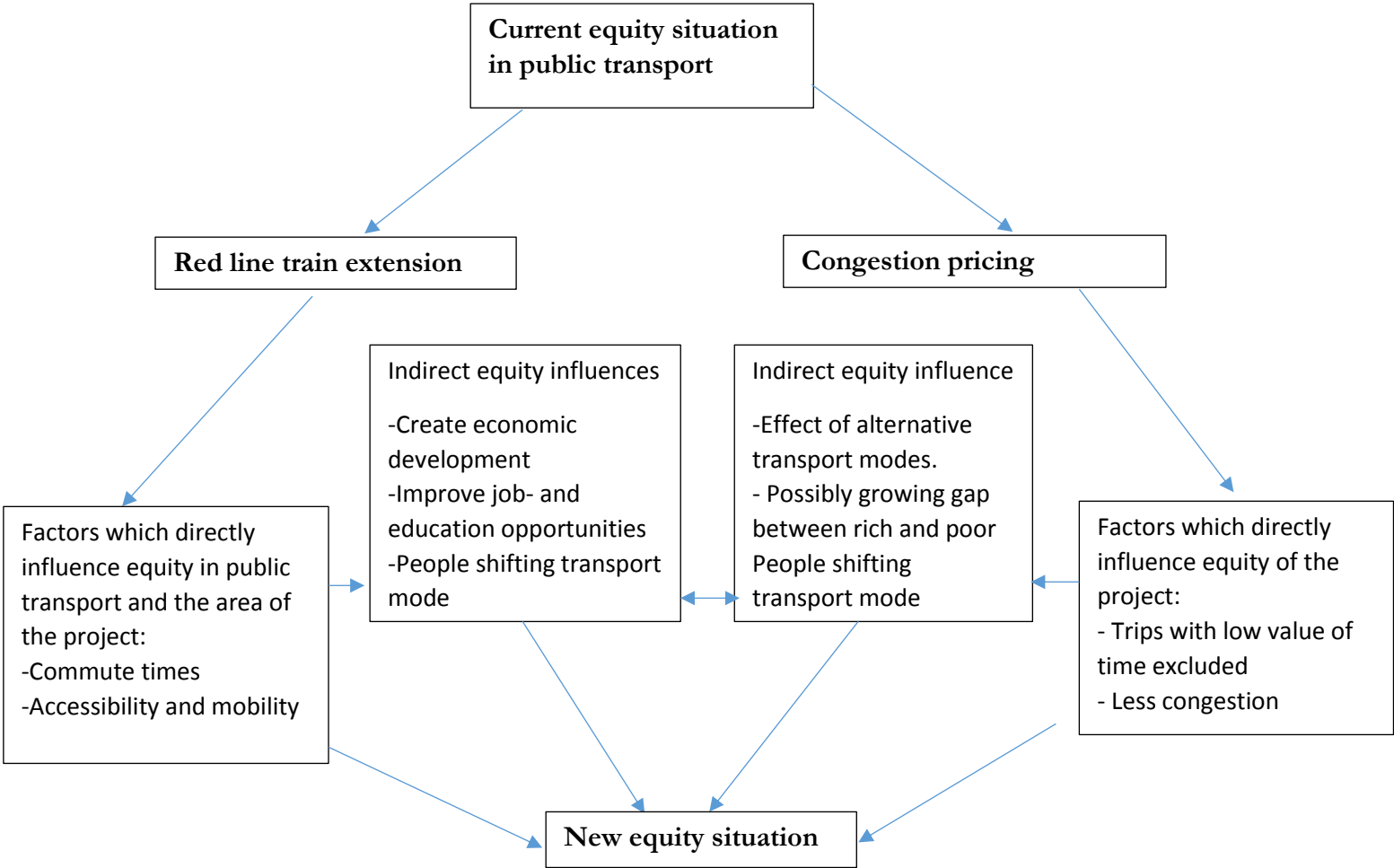
In the 2010 report the CMAP suggested that the revenues of congestion pricing would go to public transport, but the CMAP (2016, interview) later said that this is not likely because there will probably be no significant benefits and when there are benefits they are not able to be invested in public transport, because of institutional barriers. As discussed in the theoretical background congestion pricing will work according to the cost principle, because a social cost, the congestion costs, will now be paid for by a toll.

When congestion pricing is implemented, this might also have a negative impact on the poor people in Chicago. As discussed in the introduction congestion pricing is linked to the value of time (Vickrey, 1969); it decides whether people want to use the express lane or the free lane. Since the value of time is related to the wage rate, poor people have in general a lower value of time and will therefore be less likely to use the express lane. Because of the discussed income segregation in the previous chapter, low-income people live in different regions than high-income people. This means roads in these poorer neighborhoods can have a lower average value of time than roads in richer neighborhoods, which causes different demand prices for HOT-lanes (Harris & Shaikh, 2011). In the figure below it can be seen that for the Edens Highway to the north the optimal tax is more than twice as high as the optimal tax on the Dan Ryan highway to the south.

Highway	Highway location	Optimal tax	Daily cost with optimal tax	Daily cost with second-best tax	% Increase in cost	Daily cost with no tax	% Increase in cost
Eden's	North	\$16.50	\$ 4,125,611	\$ 4,142,174	0.40	\$ 5,191,728	26
Lakeshore Drive North	North	\$12.50	\$ 3,400,250	\$ 3,403,670	0.10	\$ 4,004,464	18
Kennedy	West/North	\$12.25	\$ 3,145,495	\$ 3,146,042	0.02	\$ 3,744,418	19
Eisenhower	West	\$13.75	\$ 4,880,364	\$ 4,886,537	0.13	\$ 5,819,767	19
Stevenson	South/West	\$10.75	\$ 3,321,758	\$ 3,322,117	0.01	\$ 3,965,291	19
Dan Ryan	South	\$ 6.75	\$ 2,948,763	\$ 2,963,268	0.49	\$ 3,182,417	8
Lakeshore Drive South	South	\$ 7.00	\$ 2,975,095	\$ 2,985,607	0.35	\$ 3,209,937	8
Total		\$11.00	\$24,797,334	\$24,849,415	0.21	\$29,118,022	17

Figure 13. Optimal taxes for different highways in Chicago (Harris & Shaikh, 2011).

5.4. Conceptual model of case description



Explanation of the model

This conceptual model is divided in the current equity situation in public transport, the cases which are implemented, what sort of influence this has, what factors the cases influence and how these factors are related to equity. The two cases both have indirect and direct influences on the equity in Chicago or on the south side of Chicago. The direct influences are effects created directly by the two cases. According to the case study literature, these direct effects include factors like accessibility, commute times and congestion, in the case of congestion pricing. These factors which have been influenced directly, will then influence other factors like mode of transportation. This mode of transportation is a link between the congestion pricing project and the red line extension. Other indirect effects include economic development of the red line extension area and an improvement of job- and education opportunities for people living in the red line extension areas. These are goals of the CTA for the red line extension project. Congestion pricing may indirectly cause a growing gap between rich and poor people and alternative modes for congestion pricing can also have indirect influences. Finally, all the factors have a potential influence on the equity in public transport.

Chapter 6 Results

6.1. Introduction

In this chapter the findings from the interviews will be presented. These findings have been divided in three different sections: measuring equity in the public transport of Chicago and the cases of the red line extension and congestion pricing. In the first section the way to measure equity in Chicago is discussed, with the use of the expert interviews. After this an overview is given of the indicators that are mentioned the most by experts. Also links between different equity aspects and measuring equity in public transport is discussed. For the case of the red line extension the equity impact of the red line extension is discussed, with the use of interviews and the data analysis. The congestion pricing case is presented with the use of interviews. The goal of this chapter is to provide the main findings from these topics, coming from the interviews and the data analysis. These findings will also be an important part for the conclusion of this thesis.

6.2. Measuring equity in the public transport of Chicago

In this first section of the results, the best way to measure equity in public transport is discussed. First, the relevant background of measuring equity and other factors, which are hard to measure as an indicator, are discussed. Also the way how horizontal and vertical equity should be applied in measuring equity according to experts is discussed. Then the actual most important indicators for measuring equity are presented, these indicators are also linked to the concepts of horizontal and vertical equity. Finally the indicators which are used for the data analysis are presented.

According to Manaugh (interview, 2016) the first thing that is important when it comes to equity in regard of public transport is the distribution of public funds which go to infrastructure. This is in line with the theoretical background, where is mentioned that equity in public transport is especially related to the distribution of subsidies (Hay, 1993). Public transport is very important in providing access to all kinds of facilities, like jobs, health care and grocery stores (Manaugh, interview 2016). Moreover Manaugh (interview, 2016) states:

[...] The last decades more awareness has come that the most important part of public transport is to provide accessibility, so people can create a happy and healthy live (Manaugh, interview 2016).

This statement is also in line with the theoretical background, since public transport is related to the quality of life. Welch (2016, interview) agrees with Manaugh on this point and adds that it is important to look at the individual accessibility. Whereas traditionally the most important part about equity in public transport was the distance to transit service and the frequency of this service. But what's also very important is where this service takes an individual, Welch argues. The goal should be that the transit service connects an individual to a person's job or grocery store, in this way it can be seen if the mobility of people in lower income areas catches up with the mobility of people in wealthier areas (Welch, 2016). Murdock (interview, 2016) agrees with this line of argumentation and adds that is important to connect people with the activity centres. For example, in Chicago all CTA rail lines are only connected to the downtown area, which makes the travel time to other job clusters higher, like Midway and O'Hare airports (Murdock 2016, interview). Welch (interview, 2016) says there are big differences between local counties and large metropolitan areas, since bus connections can be enough for local counties, whereas for large cities it is not. However, Welch (interview, 2016) argues:

[...] It would be good to have a common index to measure equity in public transport for every city in the United States, where one index looks at local county levels and one looks at federal funded projects (Welch, interview 2016).

Whereas Manaugh (interview, 2016) says that socially disadvantaged groups can differentiate a lot between cities, which causes that different variables are important to measure equity in different cities. Also Manaugh adds that it is important to measure equity in public transport over a certain period in time, because only then it is possible to make a valid analysis.

Segregation and equity

According to Manaugh (2016, interview) and Welch (2016, interview) segregation can have an important role in public transport. Manaugh (2016, interview) has done research on segregation where it is based on income, education levels, payment on housing costs and minority status. In the case description section it is mentioned that income and minority status are indeed important factors to base segregation on. He argues that segregation in public transport is especially a factor in cities in the US south or a city like Chicago. Welch (2016, interview) argues that in early designs of transit policies, public transport would go into the poor neighborhoods, but by the time these systems were built, they were built around the poor neighborhoods. Murdock (interview, 2016) argues the opposite of Welch and says the areas of urban low income in minority areas are very well served with transit. Although there are some older poor suburban areas that are not so well served with transit, Murdock argues.

Grimshaw (interview, 2016) thinks segregation plays a role, but also adds:

[...] Although a city like Chicago is very segregated, still poor people live all over the city, so low income people in richer areas need as much access to transit than people of low income communities. So therefore it is important to have a region wide efficient transportation network (Grimshaw, interview 2016).

Horizontal vs. Vertical Equity

When it comes to the question whether horizontal or vertical equity is more important in planning public transport, there are different opinions among experts. Manaugh (2016, interview) thinks vertical equity is more important in the American context, since certain groups have been disadvantaged for many decades. Because they didn't benefit from infrastructure funds it is fair to prioritize these groups this time with extra funds (Manaugh 2016, interview). Manaugh agrees on this point with Foth et al. (2013). In the theoretical background it is stated that Foth et al. (2013) think that first socially disadvantaged people should be helped in the distribution of funds for public transport. Welch (2016, interview) thinks that vertical equity is not better than horizontal equity or the other way around. On one hand he thinks it is fair that poor people receive more benefits, since they also have bigger needs. Welch also thinks horizontal and vertical equity makes sense from a planning perspective, since they are just ways to measure equity in the system. But this doesn't mean it is ideal as a tool to provide transit (Welch, 2016). This corresponds with the theoretical background where it is stated that it is hard to use a certain equity aspect to calculate an equal distribution (Martens et al, 2015). Grimshaw (interview, 2016) says it is important to have transit access for everyone, especially from an environmental perspective. But it is also very important to provide transit access for these people that are unemployed at the moment.

Indicators for equity

Manaugh (interview, 2016), Sriraj (interview, 2016), Welch (interview, 2016), Tandon (interview, 2016) and Grimshaw (interview, 2016) all think income is an important indicator regarding measuring equity. Other important indicators include access to employment (Manaugh, interview 2016; Welch, 2016) and the percentage of the income spend on housing (Manaugh, interview 2016). Sriraj (interview, 2016) has an index he calls transit dependency index. According to Sriraj people that are over 65, children under 18 and people without a car are important groups for this transit dependency index. Tandon (interview, 2016) also adds people with disabilities to this group of transit dependent people. This index should therefore be taken into account when equity is researched in public transport, because this is the group of people that needs public transport the most. Welch (interview, 2016) thinks it would work out well when there would be a common index with which equity can be measured. He also thinks the quality of the transit connection is an important factor. The access to employment and the match with the skills of people living in a certain neighborhood is also an important factor (Murdock, interview 2016; Welch, interview 2016). According to Grimshaw (interview, 2016) the costs of transport, the routes, connection to employment centers and the frequency are important factors. There can be a very good transit connection to an employment center, but when this train runs only once every two hours it is not very useful.

Expert				
Manaugh	Income	Access to employment	Percentage of income spent on housing	
Welch	Income	Access to employment	Match between skills of people and transit connection	Quality of transit
Tandon	Income	Transit dependent people	People with disabilities	
Sriraj	Income	Transit dependent people		
Grimshaw	Income	Cost of transport	Connection to employment centers	Routes and frequencies
Murdock	Income	Match between skills of people and transit connection		

Fig. 14. Table with most important equity factors according to experts

As can be seen in figure 14, all the experts think income is an important factor to measure equity. This is also a factor which has been mentioned a lot in the literature as is discussed in the theoretical background, so it is no surprise that it is also seen as an important indicator by the experts. Therefore this factor has also been included in the data analysis. Another important indicator according to experts is the access to employment. Besides access to employment, connection to employment centers and routes and frequencies are also seen as an important factor. These factors have been used in the data analysis as the indicator average commute time. Another important factor according to experts are transit dependent people, according to Sriraj (interview, 2016) these are people that are over 65, children under 18 and people without a car. Unfortunately, not all these data was available to include the transit dependency index in the data analysis. Instead, the percentage of people who use transit as their transport mode to go to work has been used for every zip code, since transit dependent people are included in this percentage. Other factors like quality of transit and match between skills of people and transit connection were impossible to find exact data for. The costs of public transport are similar for all the CTA services in Chicago, so this factor is not a big issue in measuring equity.

6.3. Red Line Extension

In this section the impact of the red line extension is discussed. First the current equity situation according to experts is discussed and then the influence of the red line according to experts is presented. Finally, the data analysis with the impact of the red line extension is presented in this section. This analysis not only shows the impact of the red line extension, but it shows data for the whole city of Chicago.

Current equity transport situation in the area of the red line

At this moment the far south side of Chicago is one of the regions where the average commute times are the longest of the whole metropolitan area. At the moment the transit dependent people in this area have to rely on buses. According to Murdock (interview, 2016) most people in the area still buy a car to go to work, despite the fact that is a low-income area. Sometimes people have to take multiple buses in order to get to the current end station of the red line (Farmer, interview 2016). As discussed in the research context section, there are also a lot of low income people living in the red line extension area. Another problem is that this red line station (95th street) has to deal with a lot of bus congestion, since all buses from the south side of Chicago come together at this station as also can be seen in figure 15 (Tandon, interview 2016).

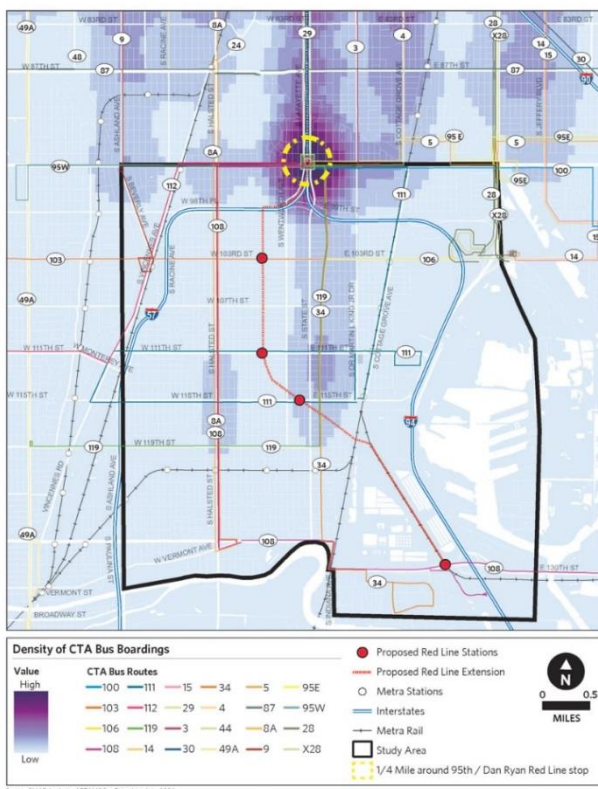


Fig. 15. Current bus congestion at the 95th station (CMAP, 2012).

Since there are not a lot of job opportunities on the far south side of Chicago, there are a lot of people who have to deal with this problem every day. The red line metro is the only CTA metro line that doesn't go to the edge of the city (Grimshaw, 2016). Since the proposed end station of the red line (130th street) lies at the edge of the city, the investment would be a good opportunity from a spatial equity perspective.

Impact of the red line extension

The red line extension aims to achieve several goals. One of them is to help the low-income people in the area of the extension (Tandon, interview 2016). There will not only be an impact of the red line between 95th and 130th street, but also to the far south suburbs (Sriraj, interview 2016; Grimshaw, interview 2016). The people in this area now see their travel time reduced, before getting on the red line. With the red line extension there are a lot of people for who the travel time to downtown will be reduced to less than 45 minutes. This is important so people from the far south side will be connected again with the economy, since most of the job centers are located around and beyond the downtown area (Grimshaw, interview 2016). According to Murdock (interview, 2016) this is not the only relevant factor, but for people it is most of the times more important if there are job opportunities or medical facilities within five minutes than the number of facilities that are accessible within 45 minutes. In the future the red line might attract more jobs, because of the increasing accessibility, so there will be more jobs within 5 minutes.

Sriraj (interview, 2016) argues that the red line extension is more needed for economic development than to increase mobility. As he says:

When the only goal of the red line would be to increase the mobility, the same goal could have been achieved with better bus services. Since one goal of the project is also to improve the economic development and livability of the area it is crucial to build a train line instead of more bus service (Sriraj, interview 2016).

With a train line economic activity can be brought to the area, and transit oriented development can be created. So the extension of the red line can be used as an instrument to uplift the entire area (Sriraj, interview 2016).

Data analysis of red line extension

In the previous section it has been said that the factors that will be included in the data analysis are the average commute time, income and the percentage of people commuting by transit. First it is discussed how these indicators have been used to create maps, then the results are presented. The average commute time and income have first been shown in a map, which is then combined with the zip code map. For the average commute times, graduated colors have been used, so the values have different colors per zip code. For the income, graduated symbols have been added in the same map, so it is easy to see what the income of a zip code is in relation to the average commute time. After these two maps were created, the influence of the red line has been visualized. In order to do so, first the citydata.com file had to be adjusted in Microsoft Excel. For the impact of the red line extension, it has been assumed that only people, who are currently commuting with public transport, will make use of the red line, since this model was not able to account for transport mode shifts. Furthermore, only zip codes on the south side of the current red line have been used for the impact of the red line extension, for which one of the new stations is the closest metro station. As discussed in the red line case study, the time gain with the new red line extension will be 20 minutes and 30 seconds. This time has been divided by the transit share as commuting mode. For example, when a region first has an average commute time of 30 minutes and has a transit share of 10%, the reduced average commute time will be calculated like this: $30(\text{original commute time}) - (0,1(\text{transit share}) * 20,5)(\text{time gain red line}) = 28,05 \text{ min}$. This meant for every zip code influenced by the red line extension, the average commute time has been reduced. The reduction in travel time depends therefore on the transit share per zip code. On the following pages the maps of the data analysis are presented, followed by the results.

Commuter Times vs. Income Chicago

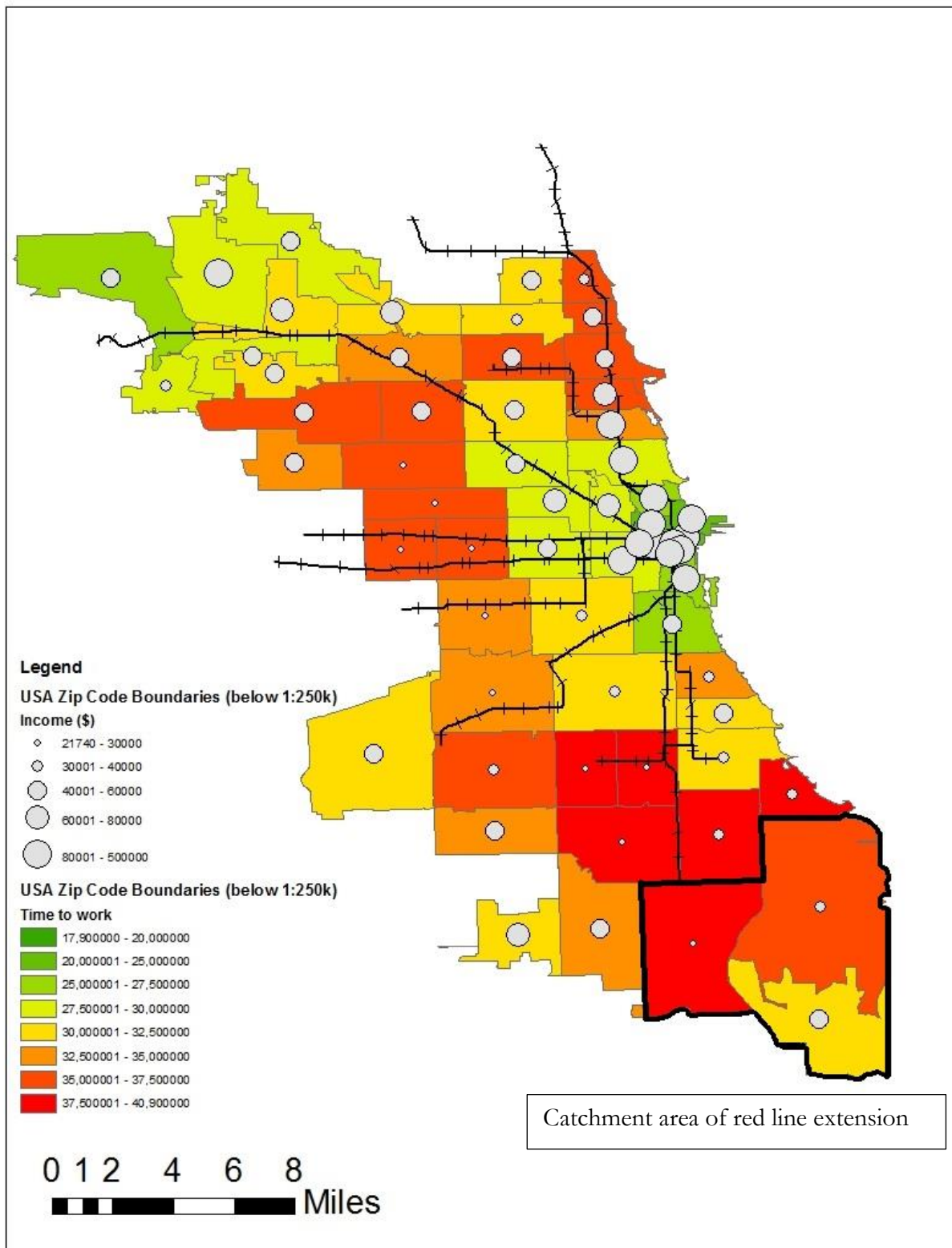


Figure 16. Commuter Times and Income in Chicago per Zip Code in the situation before the red line extension.

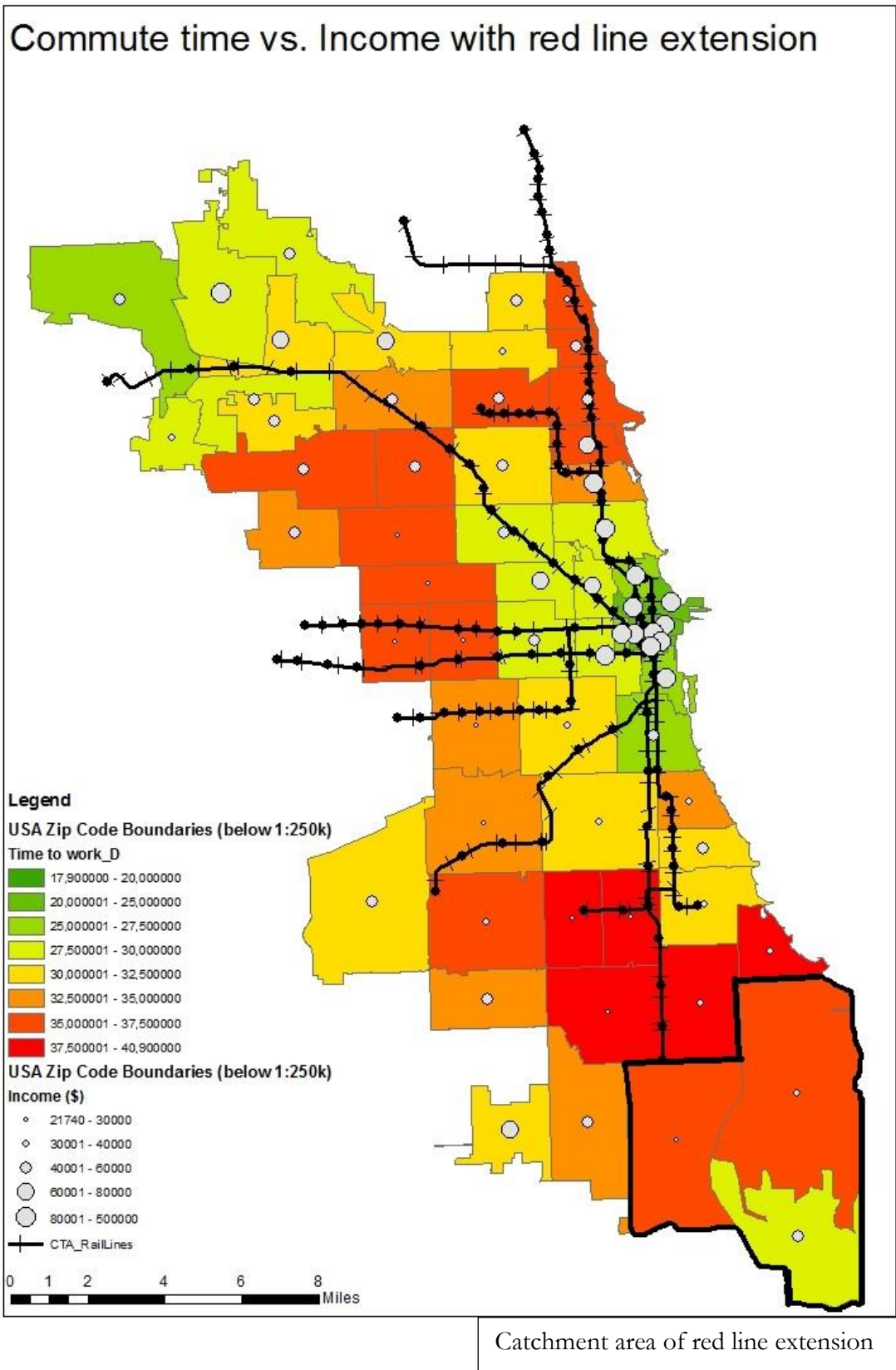


Fig 17. Commute times and income in Chicago with the implementation of the red line extension

Commute Times vs. Income Chicago

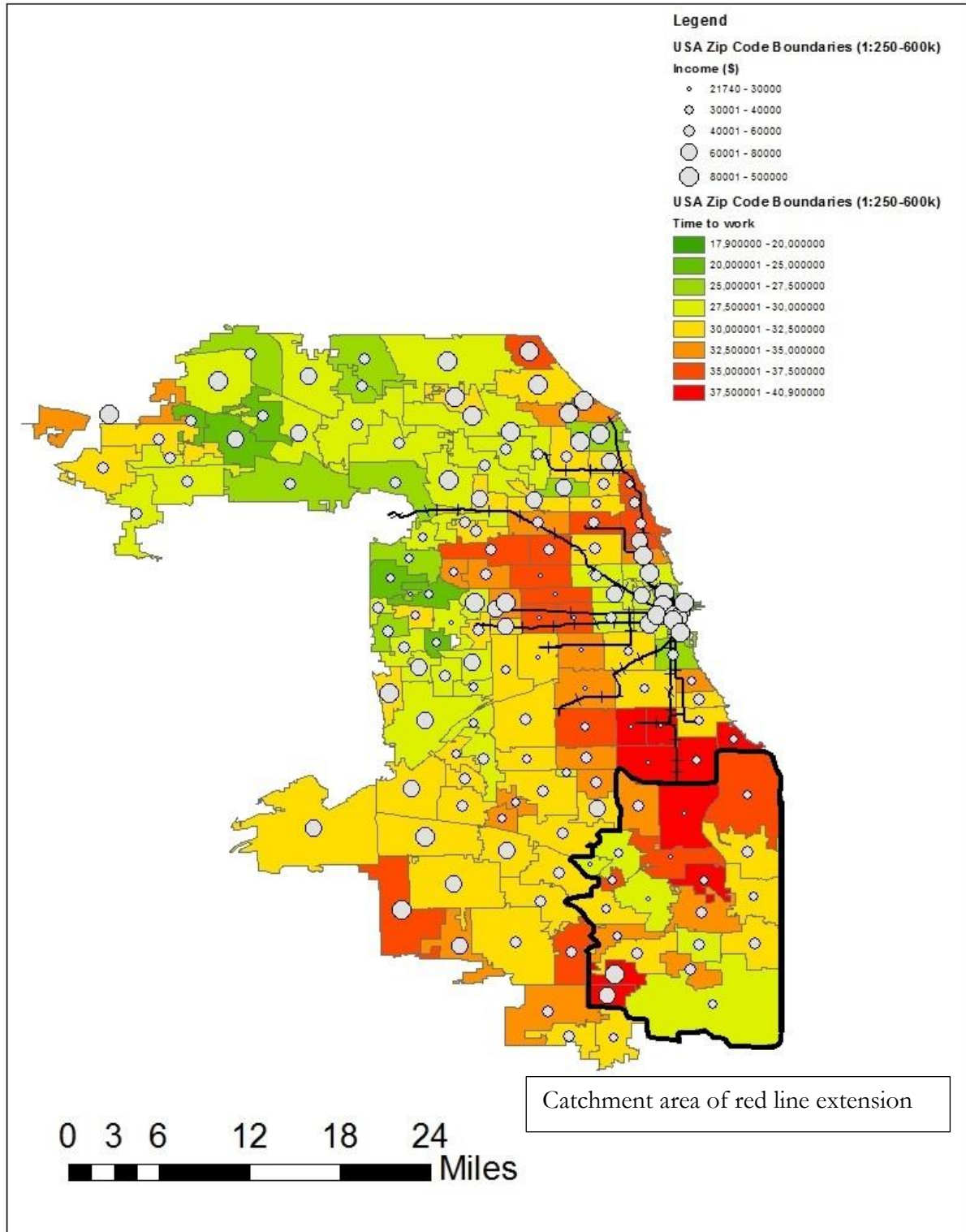


Fig 18. Commute times and income in Cook County in the situation before the red line extension.

Commute time vs. Income with red line extension

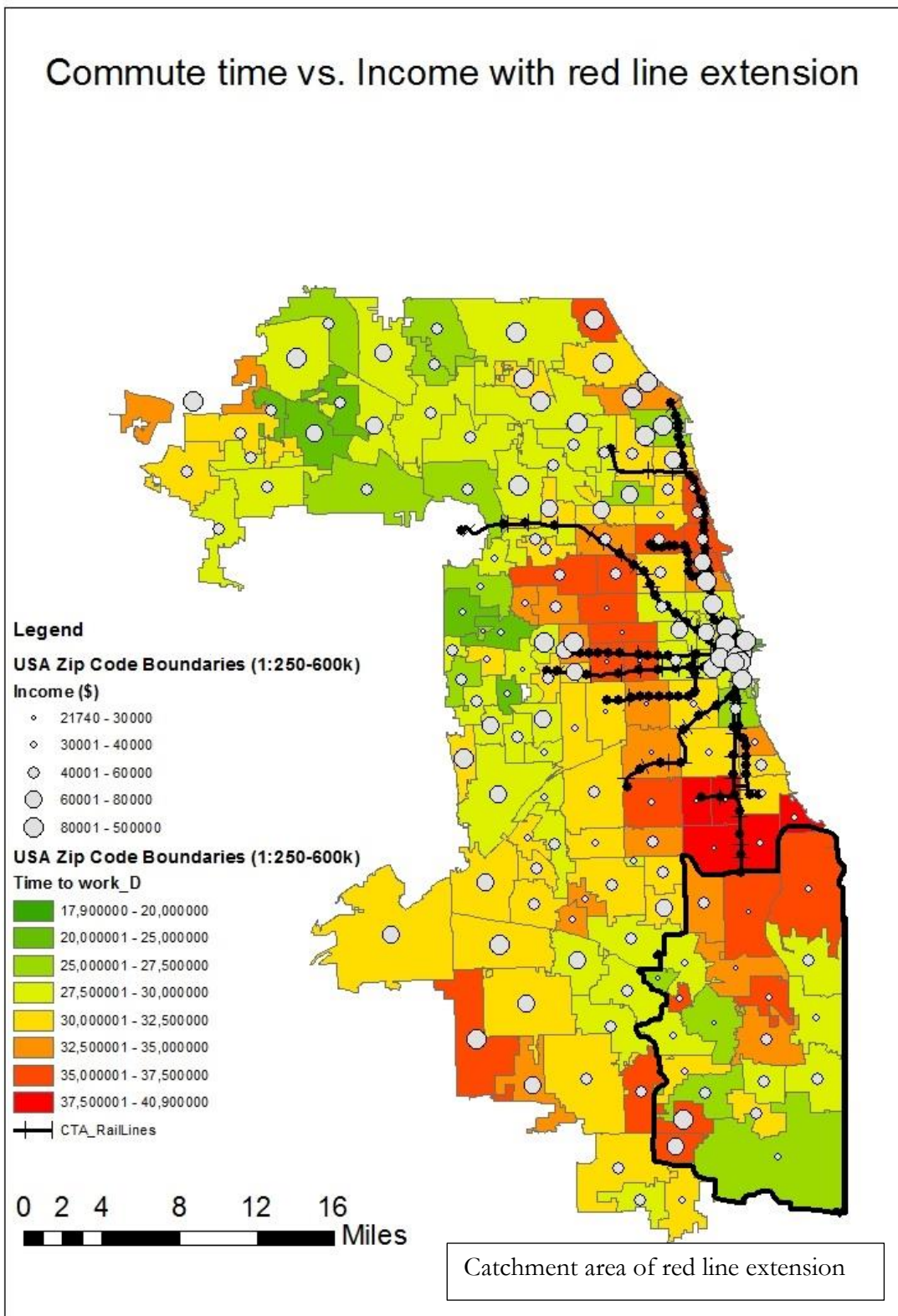


Fig. 19. Commute times and income in Cook County with the implementation of the red line extension.

Results of the data analysis

In this section the results of the data analysis will be discussed. The striking facts of the four figures 16, 17, 18 and 19 will be explained. Special attention is paid to the relation between the income per zip codes and commute times and to the impact of the red line extension. In figure 16 it can be seen, that the longest commute times are mainly located in the areas outside the city center. These are also mainly the areas with the lowest incomes. The highest incomes in the city of Chicago are in the downtown area and in the neighborhoods on the north side of the city, as can be seen in figure 16. The lowest commute times are concentrated in the downtown area and close to the O'Hare area, where also a lot of jobs are located. So it seems logical, that the areas with the most jobs also have the shortest commute times. In the area close to the red line and the red line extension, the commute times are at the moment the longest of the entire city. Reasons for this may be that there is no metro line yet in these areas, and a higher percentage of transit dependent people living in this area. Also, there are a lot of low income people in this area, for who it is harder to find a job, meaning they have to travel longer for their jobs in general.

When looking at the impact of the red line extension (figure 17), it can be seen that the influence is that not that big for the city itself, but especially for the larger Cook County region, which includes a large part of the Chicago suburbs. Because the effect of the red line extension is not limited to the city limits of Chicago the effects of the red line extension are also visualized for Cook County.

Figure 18 is the map of Cook County without the red line extension. It can be seen that average commute times start to decrease for areas further into the suburbs and away from the downtown area. Especially on the northwest side of Cook County, there are a lot of zip codes with lower commute times than in the city itself. The reason for this might be that people in the suburbs are mostly having a job in a suburban area instead of downtown. It can also be seen that in the poor neighborhoods on the south side of Cook County, there are a lot of zip codes with long average commute times, which can potentially be reduced with the red line extension. It looks like there is no relation between the income of the suburbs in Cook County and the average commute times of the Zip Codes. At least, this relation is not as clear as in the city itself. In figure 19, it can be seen that in the area of the red line extension, commute times have been reduced compared to figure 18, the situation without the red line extension.

Limitations of the data analysis

There are three limitations of this data analysis which should be taken into account. First of all, not everyone has to commute to the city center, whereas the red line extension is aimed at reducing the travel time towards downtown. There are also a lot of people, especially in the far suburbs, who don't have to go to downtown for their job. Nevertheless, there was no data available about the distribution of jobs per zip code, and therefore this could not be included in the data analysis. Also, it was not possible to include the percentage of transit dependent people, only the percentage of people who use transit as their commute mode. There was no data available on the specific age groups (18- and 65+). Therefore it has been assumed that the percentage of people who take transit to go to work still use transit when the red line is extended. For the people who currently commute by car, it is assumed that they will not change their transport mode due to the red line extension. Therefore, no substitution between taking transit and driving has been incorporated in the analysis, which is the last limitation of the model.

6.4. Congestion pricing

The influence of congestion pricing on equity and public transport is a complicated issue, since there are a lot of factors influencing the process. The first important issue is the investments in alternative transportation when congestion pricing is implemented. Most experts agree in the fact that alternative modes of transport have to be provided in order to be equitable. Farmer (2016, interview) argues that the investments of the revenues of congestion pricing in public transport could boost the transportation system. Although, this would be the best solution according to Farmer, she is skeptical that this will happen since she thinks this money will first be used for operational expenditures. Therefore she says:

[...] Congestion pricing is in theory not that bad, but I am afraid that in practice it will expand inequity (Farmer, interview 2016).

Grimshaw (interview, 2016) also thinks that revenues of congestion pricing should be invested in public transport. She argues that with the revenues projects like the red line extension can be build. When this money is used to invest in public transport, lower and middle income people will shift their mode of transport to transit, as is proven in other cities (Grimshaw, 2016). According to Murtha (2016, interview) there are institutional barriers towards a transfer of congestion pricing revenues to public transport. He says:

The revenues won't cover the costs of implementing congestion pricing. And if the revenues would cover the costs, there are a lot of institutional barriers towards a transfer of money to public transport (Murtha, interview 2016).

For example, the congestion pricing project will probably be a public private partnership and the private partner is not interested in investments in public transport. According to Bozic (interview, 2016) it is not necessarily true that congestion pricing has to be done with a public private partnership. Murdock (interview, 2016) argues that alternatives have to be provided for those people who can't afford to pay a toll for a congestion priced lane. One proposal in which an alternative is provided without a lot of costs, is to allow the Pace bus services on the congestion priced lanes (Murdock, interview 2016). With this proposal regular drivers pay a fee to use this congestion priced lane, and the Pace buses can also make use of this lane for free. Passengers would just have to pay the regular ticket fee. At the moment there is an express bus lane which may only be used by Pace buses, which has resulted in 400 percent more passengers.

Consequences for people with lower incomes

Since congestion pricing is related to the value of time, as discussed earlier in this thesis, trips with a lower value of time will not make use of a congestion priced lane. According to the theory that the value of time depends on the wage rate, this would mean that lower income people are not able to make use of the congestion priced lanes. Experts have different opinions about this. Murtha (interview, 2016) says that lower income people have a bigger need to be in time at their job, since they have a lower job security in general. So it is more important for them to be in time at their job, and with congestion pricing they have the economic choice to be in time, Murtha (interview, 2016) argues. Farmer (interview, 2016) argues that lower income people will have to spend more time in their cars than richer people, which leads to two things according to her. On one hand she argues it will expand inequity between rich and more people. On the other hand lower income people will shift towards public transport. Bozic (interview, 2016) says that the most important factor of congestion pricing is reliability. With congestion pricing the travel time

is always equal when people use the express lanes. When reliability is the ultimate goal of congestion pricing this means most efforts are made to reduce the travel time of the people who use the express lane. Since these are people with a higher value of time and so in general a higher income, this would expand inequity. Grimshaw (interview, 2016) thinks the level of the toll fee can depend on the income of a car driver, so lower income people can pay less than higher income people. This has been introduced in Minneapolis, she says. This can be done by linking a car transponder to an account where the income is displayed. Murtha (interview, 2016) also thinks it is important to look at the equity effects of congestion pricing in other cities, to see if the same strategies can work in Chicago.

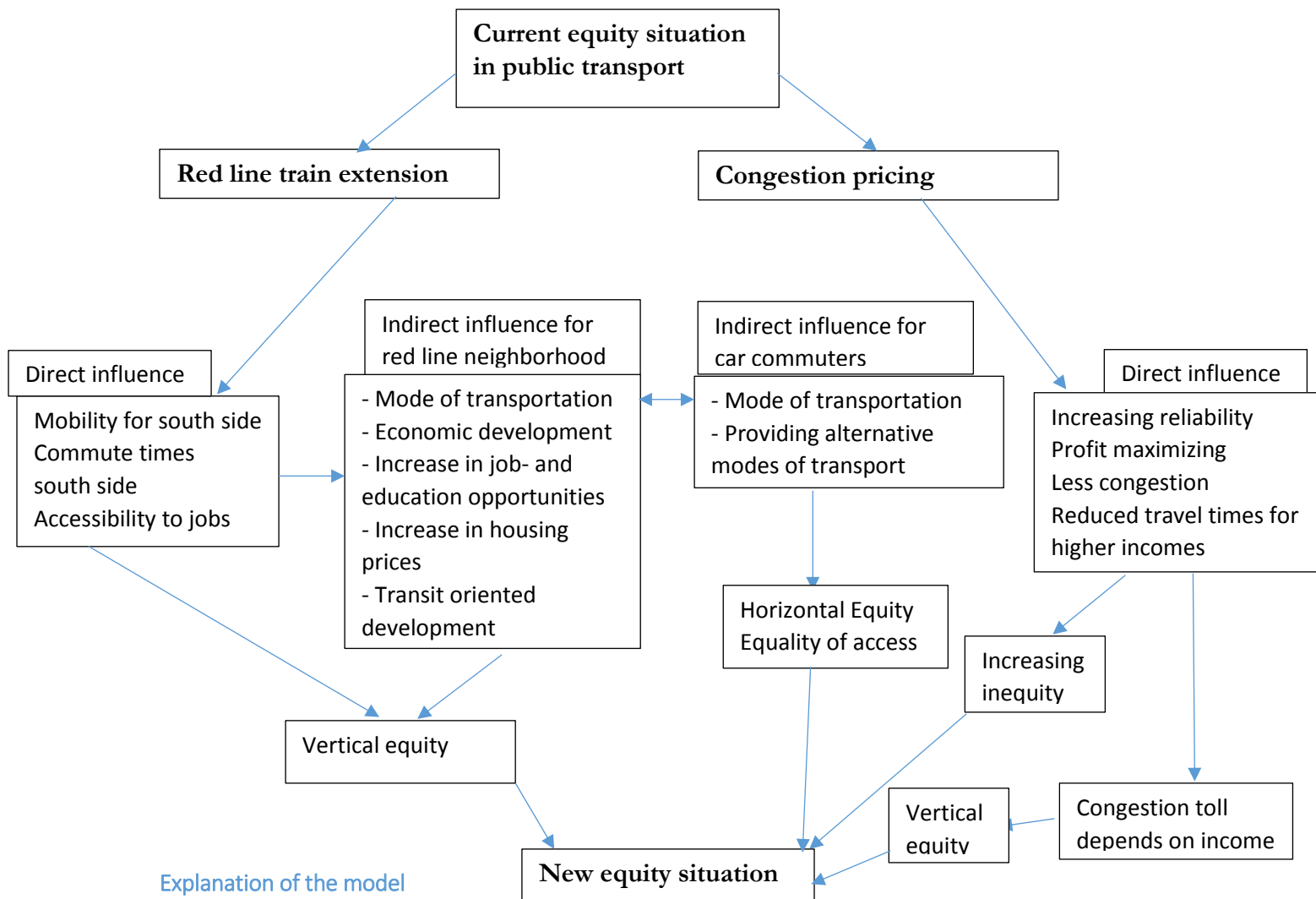
Background experts related to results

For this master's thesis several persons have been interviewed with different backgrounds. These experts can roughly be divided in experts with a background as researcher, and experts with a background in an institutional or governmental organization. These include the CMAP, CTA and CNT (Center for neighborhood Technology). Whereas the CTA is the provider of transit services in Chicago, the CMAP and CNT are both agencies who contribute to infrastructure projects by doing research and writing reports. So, it can be said that the researchers have in general a more independent opinion about the cases of the red line extension and congestion pricing. The other three organizations have an active role in these projects. The CNT thinks transit and infrastructure in general, should be distributed equally to all citizens of Chicago. CMAP is the organization that proposed congestion pricing in Chicago and is doing research on the red line extension, the CTA obviously has a big role in the red line extension. For the red line extension, all experts agree that the extension can be a good investment. Although especially CMAP and CTA think the red line extension is vital to get people to their jobs and to increase mobility, Sriraj (2016) thinks the mobility can also be increased with buses, but he argues a train line brings more economic development. For the case of congestion pricing, the differences are clearer. All experts think congestion pricing will expand inequity, except the interviewees of CMAP, who think equity is not a big concern for the project. It seems logical that CMAP has this opinion, since it is the organization who proposed the project.

Linkages between results and relation to equity aspects

The results of this thesis make clear that congestion pricing is initially aimed at profit maximizing, from all equity aspects of the model on page 15. In this situation inequity between income classes would grow. By providing alternative modes of transportation, horizontal equity can be achieved, so all citizens have equal access. With the proposal of Grimshaw (2016), to let the toll fee depend on the income of car driver, the vertical equity situation can be improved. It is unlikely to transfer congestion pricing money towards investments in other transit modes, and there will be probably be political pushback towards this proposal. The red line extension is especially aimed at improving accessibility and creating economic development for a low income neighborhood, so people from the whole Chicago region pay to let citizens of a low income neighborhood have better accessibility, which is a form of vertical equity. There are a lot of similarities between the objectives of the red line extension, which are presented in the case study, and the indicators for equity. This means a lot of goals of the project are related to equity, this is not the case for congestion pricing. In the congestion pricing case the goal is not to improve equity, but to make sure inequity is not increased. In the conceptual model below the concepts of the results are linked to the equity aspects.

6.5. Conceptual model of the results



Explanation of the model

The conceptual model is divided in four different stages, the current equity situation in public transport, the cases which are implemented, the direct influence this has, the indirect influences it might have and how these factors are related to equity. The direct effects include the effects that immediately take place after the implementation of the projects. Since the red line train is implemented in the south side of Chicago it will especially influence the travel behavior of the people in this part of the city, whereas congestion pricing will probably be implemented on different locations in the city. That is why the accessibility and travel times for south side residents will only be influenced by the red line extension. The direct influences are effects created directly by the two cases, like accessibility to jobs and commute times in the case of the red line and congestion and reliability, in the case of congestion pricing. For the red line case, the train line can let people decide to take transit instead of driving. The train line can also create economic development, as Sriraj (2016) mentions. Eventually this can lead to transit oriented development. Since in the case of the red line a low income neighborhood will have better accessibility, this is a form of vertical equity. For congestion pricing there are three scenarios in the conceptual model. Congestion pricing itself is likely to increase inequity. When alternative modes of transport are provided, there will be more equal access again for everyone and when congestion tolls will be lower for lower incomes this will lead to vertical equity. So, for this case it depends on which scenario is chosen what the effect on equity will be.

Chapter 7 Conclusions

In this thesis the influence of the red line extension and congestion pricing on the equity in public transport has been researched. For this research, several ways of data collection have been used. Relevant literature has been used for the theoretical background and for the chapter of the two case studies. A data analysis has been executed in order to visualize the impact of the red line extension. Finally, interviews have been executed to see the opinions of experts on the influence of the two case studies on equity. With these methods of data collection being finished it is now time to answer the research question. The main research question of this thesis is:

What is the current situation of equity in the public transport system of Chicago and is there an influence of the red line extension and congestion pricing in this system?

Since this question is divided into different parts, the question will also be answered in different parts. First the current equity situation in Chicago will be discussed, then the influence of the red line extension and finally the influence of congestion pricing will be discussed. Finally, overall implications for equity issues in infrastructure projects are discussed.

7.1. Current equity situation in Chicago

Public transport has been an important transport mode in Chicago since the start of the 20th century, although in the second half of the last century this mode share started to decline due to suburbanization, and more people commuting by car. Since the early 2000s more people are moving back to the city and use transit again, which means there is more money again for investments in public transport. There is still a big debate however about how this money should be spent, whether economic core projects should be prioritized or projects aiming to help transit dependent people. As discussed in theoretical background, the wealthier suburban commuters have been prioritized over the years in the United States (Farmer & Noonan, 2011; Garreth & Taylor, 2011). Now that more people start to use the transit system again because suburban people are moving back to the city, there is more attention again for projects within the city limits, with the red line extension as one of the most important examples. Other important aspects regarding equity in the transport system of Chicago are transit oriented development and segregation, as discussed in the case description chapter. Transit oriented development takes place especially in the areas of Chicago along older rail lines, which are located closer to the city center. This is an effect that takes decades, and therefore takes place at stations that already exist for a while. Due to transit oriented development a neighborhood goes through a phase of economic development, but on the other hand rent prices go up, forcing lower income people to leave their houses.

Indicators and analysis to measure equity in public transport

In this thesis, indicators to measure equity have been investigated. All the experts think income is an important factor to measure equity. Access to employment and accessibility are other important indicators according to experts. These factors have been used in the data analysis as the indicator average commute time. Other indicators that could not have been in used in the data analysis are transit dependent people and quality of transit. This thesis has contributed in a way that experts have been asked about what they think are important indicators for equity, these

indicators have then been used for the data analysis. The factors average commute time and average household income have been visualized in a map to see the distribution of these two factors. It was shown that average commute times started to rise for areas further away from downtown, especially in the poor neighborhoods of Chicago. In the suburbs, this average commute time was reduced again for most areas, and also the income started to rise again. So it can be said, that there is a relation between low income areas of Chicago and higher commute times. As seen in the results, accessibility and income have been listed as two important factors for equity in the public transport system. So, it can be concluded from this thesis that at the moment both the vertical and horizontal equity situation in Chicago are not that good, since lower incomes have longer travel times.

7.2. Red line extension

The region of the red line extension has some of the highest average commute times of the city and lowest averages incomes. One of the reasons for this is the low level of job opportunities in the far south side of Chicago. At the moment there is a lot of bus congestion around the last stop of the red line metro, which is the only line that doesn't go to the edge of the city. The red line extension can help a lot to boost the economic development in the region, as it may result in transit oriented development in the long run. This happens because train stations can create an environment that attracts jobs in the neighborhood. This will lead to economic development, an increase in housing prices and eventually transit oriented development. When the only goal of the red line extension would be to increase mobility, the same could have been achieved with more buses. Since one of the main goals of the extension is to create economic development, it can be concluded that the red line extension will be a good investment, when this goal will be achieved. Economic development is one of the key goals, as CMAP (2012) states:

[...] new stations may serve as catalysts for neighborhood revitalization and help reverse decades of disinvestment in local business districts.

With the implementation of the red line extension, the percentage of people using public transport to go to work has also been included in the analysis. This factor contributed as the percentage in which the average commute time would drop with the red line extension. It was found that for most areas around the red line extension the average commute time will drop with around 3 minutes. The most important finding was that the extension is implemented in an area with some of the highest commute times and lowest incomes of Chicago, making it a very good investment from a vertical equity point of view. As the data analysis showed, the red line extension is a good investment from a vertical equity point of view. It helps to create an equitable distribution of transportation benefits, as discussed in the theoretical background. Also, it will create a more fair system from a social justice point of view, according to the definition of Beyazit (2011). Although, there are some limitations in the model, it can be concluded that the red line extension has a good potential to create a more equitable transport system in Chicago.

7.3. Influence of congestion pricing on equity in public transport

As discussed in the case study chapter, the value of time is an important concept for congestion pricing. As Vickrey (1969) argued with congestion pricing, trips will be segregated based on the

value of time. And since the value of time is related to the wage rate, people with lower incomes will shift their transport mode more likely to public transport than higher incomes. For these higher incomes the mobility will grow, which means their commute time will be reduced. Therefore it is very important to provide alternatives for people with lower incomes in order to prevent inequity. Of all the experts only Murtha disagrees with this theory. He says that lower income people have a bigger need to be in time at their job, since they have a lower job security in general. Therefore their value of time grows so they will also make use of the express lanes. The fact that Murtha thinks congestion pricing itself is not bad for equity, may be because he is working for the organization that tries to implement congestion pricing. The other experts all argue that it is important to use the revenues of congestion pricing for investments in public transport as an alternative mode of transportation. Even though it is not sure if the revenues of congestion pricing will make up for the costs. And even if they would there are a lot of institutional barriers towards this money transfer.

An alternative that is relatively cheap is to let buses drive for free on the express lane. In this way people without cars or people who can't afford to pay the toll fee can also make use of the express lane for a regular price. Another alternative would be to let the price of the congestion fee be based on income, although there may be a lot of criticism on this proposal from people with higher incomes. The main conclusion is that alternatives have to be provided for people with lower incomes in order to increase the mobility for everyone. Otherwise it is very likely that congestion pricing will expand inequity, as explained in the conceptual model of the results. So, this thesis has contributed since it has shown alternative modes of transport have to be provided or people with lower income can pay less when congestion pricing is implemented, otherwise it is likely to expand inequity.

7.4. Lessons of infrastructure projects regarding equity

In this thesis, two different cases have been researched, in both cases the scope of the research was on the effect of an infrastructure project on the equity situation in the transport system of Chicago. Besides these similarities, the cases are completely different. This section will show what policymakers can learn from these projects in regard of equity. In the United States for every infrastructure project an equity analysis has to be executed. For the red line case, the equity effects seem to be quite obvious and all experts agree that there will be positive equity effects for this project. For the case of congestion pricing an equity analysis has also been executed, and it is said that low income drivers will also make use of the congestion priced facilities. So, in this case equity is researched in a sense whether people will still make use of the road, instead of whether it really is inequitable in the context of value of time.

Another important thing regarding equity lessons is that a project itself can be inequitable, but when other measures are being taken the equity situation can remain the same or it can improve the equity situation. This can happen in the case of congestion pricing when alternative modes of transport are provided or when people with lower incomes will pay less. So therefore it can be said that an inequitable project can be compromised with investments in complementary projects which improve equity. Although in these cases it is important that the complementary project doesn't depend on the success of an inequitable project. In the case of congestion pricing, alternative modes of transport might not be provided when there are not enough revenues. This will clearly not have a positive effect on the equity situation.

Chapter 8 Discussion

In this thesis different cases have been researched, which are influencing the equity of the Chicago public transport system. These cases have been discussed separately. Since the cases of congestion pricing and the red line extension are both very different in essence, it was hard to use them to draw general conclusions. Therefore they have been used as separate cases. Because these cases have only been used separately, there is not always enough cohesion in the thesis between the different cases, since they are all treated on their own.

In the theoretical background of this thesis the focus has been on equity, different aspects of equity and ways to measure equity, whereas the two cases were discussed in the case study. This made sure all three components of the thesis were investigated separately. The combination between a data analysis and interviews with experts was a valuable addition to this thesis, also because similar results came from these data collection methods. The data analysis did show some valuable results, although the method could be improved on some points. The data analysis showed only commutes to the city center, it was not possible to include the group of transit dependent people and no substitution between driving and taking transit has been implemented. Since it was not possible to include these factors, the data analysis has some limitations and might be improved in the future.

8.1. Recommendations for further research

For further research it would be interesting to see if there is one ideal way to measure equity, as Welch (2016) proposes. It is interesting to see whether the indicators of equity can be measured in the same way everywhere in the same way. It might also be the case that equity is everywhere context dependent, as Manaugh (2016) says.

In regard of the red line extension, it is interesting to see what the eventual effects will be of the project in the context of equity. In this thesis it has been concluded that the red line extension has the potential to not only improve the mobility of the region, but also to boost the economic development of the area. In the data analysis it has been shown that the red line extension has a positive effect on both horizontal and vertical equity of the Chicago transport system. Further research in around 20 years can show whether these projected effects indeed have happened. It can also be seen if the first steps towards economic development already took place.

For the case of congestion pricing, the first interesting part for future research implies how congestion pricing will eventually be implemented. Whether there are enough alternative modes of transport provided and if these alternative modes of transport are indeed effective. It is also interesting to see what the effect of congestion pricing itself is on equity. Almost researchers said congestion pricing will actually increase inequity, and it is therefore interesting to research the eventual outcome of the project. Finally, it is interesting to research similar projects in different cities, and to see what the predictions are for these projects. Congestion pricing has been implemented in different cities, and it is interesting to see what the equity effects are in these cities. Another idea for future research is to investigate a case similar as the red line case, where a transit investment is implemented in a poor area of a city.

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Appendix

Data Analysis figures and tables

Districts	Population (2010)	Density (square mile)	Cost of living	Gender (%male)	Education (high school)	Education (bachelor)	Time to work	Unemployment	Age	Income
Downtown north (60602)	1,463	16,809	106.9	44.6%	100.0%	72.1%	17.9 min	0.6%	32.4	\$184,179
Downtown South (60604)	570	4,483	108.0	54.2%	97.9%	85.1%	28.6 min	7.1%	54.0	\$134,908
Downtown mid (60603)	493	6,087	112.2	41.3%	100.0%	86.3%	20.6 min	6.7%	26.1	\$183,116
Chicago Loop (60606)	2,308	10,917	107.2	56.1%	99.1%	89.8%	24.8 min	1.1%	30.9	\$120,832
New East Side (60601)	11,110	25,184	109.8	49.8%	98.7%	79.6%	22.4 min	3.4%	36.6	\$130,699
West Loop (60661)	7,792	25,003	106.9	48.5%	98.8%	85.7%	27.2 min	4.8%	31.0	\$96,194
River North (60654)	14,875	26,129	109.0	48.1%	97.7%	82.6%	23.5 min	7.8%	32.8	\$134,995
Museum Campus (60605)	24,668	20,052	108,3	48.2%	95.2%	75.1%	27.4 min	5.3%	33.1	\$103,524
Moody Bible (60610)	37,726	33,041	107.9	45.6%	96.0%	71.0%	26.4 min	6.3%	34.3	\$104,943
Northwestern University (60611)	28,718	36,005	109.5	46.1%	99.2%	81.6%	24.6 min	8.0%	39.5	\$179,953
University village (60607)	23,897	10,833	106.9	48.4%	94.6%	74.3%	27.7 min	8.2%	30.6	\$91,815

no vehicle per household	1 vehicle	2 or more	Total cars	Average house value	Alone in car to work	Carpooling	Public transport	Bicycling	Walking	Work at home	Distance to center
61,6%	32,0%	6,5%	294	\$325,700	16,6%	0,0%	18,4%	0,0%	63,5%	1,5%	500 m
19,1%	48,9%	31,9%	141	\$528,100	33,8%	1,5%	10,2%	0,0%	44,0%	10,5%	750 m
34,2%	41,7%	24,2%	120	\$643,800	19,7%	0,0%	15,5%	0,0%	60,4%	2,1%	900 m
18,6%	70,1%	11,4%	819	\$338,800	20,7%	2,4%	19,1%	0,7%	44,3%	9,0%	900 m
21,2%	64,7%	14,2%	2173	\$494,200	24,8%	13,4%	3,1%	1,5%	44,0%	5,3%	1,5 km
14,6%	72,1%	13,3%	1762	\$340,400	27,3%	4,0%	20,3%	1,5%	39,7%	5,1%	1,5 km
25,1%	59,5%	15,4%	4275	\$404,100	26,2%	1,3%	15,1%	0,8%	43,2%	6,4%	1,6 km
21,3%	62,0%	16,7%	6140	\$344,300	32,7%	4,8%	29,5%	1,8%	18,9%	9,5%	2,1 km
23,3%	58,5%	18,2%	8903	\$396,600	24,8%	3,2%	35,3%	2,0%	21,4%	7,5%	2,2 km
29,1%	55,0%	15,9%	9324	\$464,400	27,9%	3,0%	19,8%	0,8%	35,1%	7,6%	2,7 km
5,2%	69,7%	24,9%	5640	\$340,000	39,0%	3,7%	26,9%	2,8%	21,2%	4,7%	3,7 km

Fig. 1. Example of the demographic data from www.city-data.com for all zip codes in the downtown area

Interview Transcripts

Tom Murtha

Chicago Metropolitan Agency for Planning

02-02-2016

Introduction

Tom Murtha is a senior at the department of Policy & Programming at the Chicago Metropolitan Agency for Planning. As a policymaker his main interest lies in the field of congestion pricing. He has worked for years on this topic and has contributed to the highway congestion scans, which have been used for the data analysis of this thesis. For this interview we have agreed on an in person interview at the headquarters of the Chicago Metropolitan Agency for Planning in the Willis Tower.

Goal of the interview

The goal of this interview is to become more familiar with the topic of congestion pricing in Chicago. So far only literature has been used for this thesis, so interviews are a useful tool get more inside information of the topic.

Process of implementing congestion pricing

These are major capital projects, which have a timeframe of more than 10 years. All roads have their own project. The Interstate 290 project has been identified in 1995. The Illinois 53 project has already been identified in the 1960's, but was for a long time opposed by communities. The Interstate 90 project has been identified in 1997. The Interstate 55 is a recent project. So, the timeframe for these projects take decades. The plans consist of the project itself and congestion pricing has been adopted in those plans. Congestion pricing was implemented as a strategy to manage the roads. They have been adopted in the plans, with strategic recommendations and now they are object to additional study. On I-55 and I-290 the Illinois department of transportation is looking closely to implement congestion pricing. The CMAP can't just pick one option and study this, we have to look at a lot of alternatives. For the I-290 different options like managed express lanes, single express lanes and HOV express lanes have been researched. And they have selected the one which makes most sense, and in this case that will be one express lane.

Congestion pricing in Chicago

Our regional models have indicated that all the projects could use congestion pricing, but more detailed studies showed that there was less congestion than our models indicated. During the initial implementation of that project, congestion pricing won't be a part of that. There wasn't enough congestion to price, and it's kind of a policy question that you've got, so there is regional resistance from taking existing capacity and pricing it. So, basically adding a toll, what might be a very expensive congestion toll to a lane that's right now free, there's a lot of pushback against that. So, when you add new capacity, you toll that new capacity and you can better optimize it. So, in this case there is congestion on I-90, when we would have implemented congestion pricing on the existing lanes, the pricing may have been enough to diminish the congestion, then there's no need anymore for congestion pricing. But, volumes may grow, and the tollways are built in such a way that they can toll it in a later day.

Congestion pricing doesn't come close to paying for the new capacity. So, new capacity is very expensive. The Jane Addams project is about 5 billion dollars, and the Elgin O'Hare project as well. Pricing at the peak for some vehicles is simple, it makes the operation for that lane work, but the revenues are very small compared to the price of the project. So people talk about the money that comes from congestion pricing, but in fact as long as we speak about expressed tollways, where most of the traffic isn't even tolled it just simply doesn't make a big difference. That having been said, if congestion pricing works then you can use it to maintain capacity a lot better than an unmanaged lane. So, a congested lane, that might run 20-30 miles per hour, the capacity of that might only be a thousand or twelve hundred vehicles, if you have a road running at 45 or 55 miles per hour, would be 1800 vehicles per hour, so when the road is congested you lose capacity at the very point at which most vehicles need that capacity. You price it, so high speed and high capacity are maintained. So these are the sort of issues they're thinking about, for both the Elgin O'Hare and the I-90 the short term decision is to defer congestion pricing, because it is not needed, all this new capacity obviously needs for congestion pricing, that won't be the case for the I-55 and the I-290. The I-290 and I-55 have very high levels of congestion and the I-90 and Elgin O'Hare have high levels, but not that high.

Cordon pricing vs. Expressways

There are different ways to implement congestion. Some of the proposals to implement congestion pricing involve perimeter pricing (cordon pricing) like they have in London, rather than an expressed tollway you would put meters around the loop and people going into the loop would pay extra costs. That had been considered by the city and has been submitted as a proposal, but it was never voted on by the council. Cordon pricing is an overall means of managing overall demand for travel, but it doesn't have necessarily the operational benefits. Remember how I told about the managed express lanes, where you can set the price to maintain the speed at the right level. Cordon pricing doesn't have that impact. It isn't a very specific system. On the expressways we are prioritizing mobility on the Interstate routes, toll lane pricing would at least allow some traffic to drive through at high speeds. That's a benefit of an expressed lane over a cordon priced project. The disadvantage of the expressed lane is that the revenues go to paying for that additional lane, you can't take toll lane revenue and give to a transit system. The city of Chicago maintains most of the roads but not the expressway, so it's a jurisdictional question.

Public transport in Chicago

A lot of the expressway traffic is not directed to the city center, but just to go through, so that's also an issue. It is true that the cordon around the CBD would have the impact of probably improving transit mode share for the CBD. But that's not cost free. So, like a lot of cities during the peak period Chicago has a transit congestion problem. So you can stand on a blue line platform, as the train comes in, but there's not enough room to get in the train. So it would be good to have more people going with public transport, but it requires more service, and that's expensive. But still this is an open question.

Initial phase of implementing Congestion pricing in Chicago

Just adding additional lanes was an alternative for congestion pricing, but also managing the expressway better in other ways. So, if there is a crash, clearing the crash quickly, managing the traffic so secondary crashes don't occur, so quick clearance. Managing special events, so

providing travel information, so everybody understands what the traffic times are, so travelers can choose to divert around it. These things help, but they're not sufficient, so adding congestion pricing is still needed.

Congestion pricing and highway sections

We did look at a broader set of projects that were underway, there were other projects that were analysed in our travel demand projects, which didn't make the cut. Well, there are some roads where this is a problem, but these were not considered because congestion pricing could only be implemented on existing projects. MPC commissioned a study to pick existing lanes and price these, they proposed to implement this on Kennedy I-94. They did a study and their preliminary results were that it would be beneficial, but again the problem is that tolling existing lanes is difficult to pass because of political reasons. Technically, there are huge advantages of doing so, but politically it is a big ask.

Congestion pricing and learning from other cities

We were impressed with the 91 express lanes in California, because afterwards there was better safety, better highway performance, more capacity. The areas of concern are probably the popular politic aspect, so what does the agreement with the concessionaire, are you really giving an advantage to this private road operation, when you really need to build a road down there. But the agreement prohibits that, because they don't want competition, so making sure that a private enterprise gets a fair profit, but not more than a fair profit. Also controlling the risk of traffic, so building needs facilities assuming a volume of traffic, and you may get revenues from that facilities that you can use to help pay for the project. The problem is when it is with a private enterprise in particular, who takes the risk, when the traffic doesn't grow, when there isn't the demand which you thought there was. I guess we'll be looking towards cities like Miami, Seattle, Washington, Houston where congestion pricing is now being implemented. In Minneapolis congestion pricing was implemented on the most constrained and really going towards low cost, with a shoulder lane which would be congestion priced. This is actually closest to the Stevenson expressway, so this would be the best comparison. Miami is more a capital intensive project. But you know, they're both places where it worked out well.

Congestion pricing and equity

People with lower incomes often have less choice for choosing their jobs, which means they are tied to certain schedules and they have to travel over a bigger distance because of the spatial mismatch of jobs and housing, so right now with limited capacity and no choice but to face congestion or to go by low speed transit. The folks that are most often using the low speed transit are the ones with lowest income. It is true that a priced express lane will be less attractive to the lower income people, but there may be an economic cause to use a priced facility, for example people who need to get to their job on time, who may need to get to day care to pick up their child, this also accounts for the lower incomes. So the idea is to provide more economic choice so people can decide what's most appropriate for them. So what we've read about the experience from other towns doesn't indicate that those facilities are just for rich people, but for people with a variety of incomes depending on their needs. But it is an issue that needs to be addressed and there are a lot of ways to address it. First, we invest in better transit on the expressed toll lanes, stimulating carpooling to use the expressed toll lanes. It is good to look at other cities and how the facilities work over there in general. Congestion pricing is typically paid

by car registration fees, gas taxes, usually for the highway improvements local residents don't have to pay directly. So there are local costs, but the costs for the highway improvements will be paid by the state and USDOT, local governments may have to pay for facilities at the side of the roads. We have occurred a lot of resistance against congestion pricing itself, mostly against the fact that they're building new highways itself, like IL-53. This proposal has been changed, but it is still a project although many local residents don't want it. The opposition to those new roads is often very locally.

Congestion pricing and public transport

Our policy is that express bus lanes and express toll lanes go together. Because you have better service, right now the buses on the highways are also facing congestion, so one thing we've done is adding shoulder lanes on the Stevenson expressway, so they're able to bypass the congestion. So their reliability has improved dramatically and the speeds really improved, they have attracted more riders and they have added more buses. We have a lot of commuters who use the buses who live about 40 or 50 minutes from the city center and with these buses on express lanes the time decreased a lot to get into the city center.

We are actually funding with the CMAP some Park & Ride facilities and bus facilities along I-55 and I-90. So with buses on expressways we want to set up a suburban based network, going on high speeds.

There are institutional barriers towards a transfer of money from the toll roads to public transport, and I don't think it's been entirely worked out. I am sceptical, because the revenues won't cover the costs of building the road. And what we did on the I-90, was using other money to facilitate the express bus lane, we didn't use the toll money for this. We're chronically short of revenues, so the policies try to find a way to do that, but again there's so many barriers to actually transfer the money of a highway project to public transport. I am really sceptical that it can happen.

Practical issues of congestion pricing

The Kennedy Expressway would be the best road for the implementation of congestion pricing.

We don't have an active capital project on that road, it has just been rebuilt in 1993, so we're not going to tear that road up, to reconstruct it with a new lane when other roads have pavement which lies there more than 50 years. If we have success with these other congestion pricing projects and people actually see the benefits then congestion pricing might be implemented on this road, at least then there's a more reasonable argument. They built the roads looking for a time plan of 40-50 years. So right now, we don't really need congestion pricing, but the problem is that the pavement is often the problem, when it's 50 years old, it's falling apart. If you have to rebuild it, do you rebuild it to what you need right now, or do you look forward to 20-30 years? And the answer is almost always that you have to build for the future.

Costs of congestion pricing

When you look at the total costs, which we would have to pay almost all anyway, simply because we have to rebuild the roads. I don't know if we have such a specific thing as a benefit cost ratio. When you talk about all the benefits, like the economic development because of better traffic reliability, decreased travel times. The short answer is that we don't really know, that's the truth.

Interview Stephanie Farmer

23/02/2016

Telephone interview

Introduction

Stephanie Farmer is an associate professor at the Roosevelt University in Chicago. She studies equity in regard of the public transportation system of Chicago. She has published two papers about this topic which have also been used in this thesis: Uneven public transportation development in neoliberalizing Chicago, USA (Farmer, 2011) and The contradictions of capital and mass transit: Chicago, USA (Farmer & Noonan, 2014). For this interview we have agreed on a telephone interview.

Equity in the public transport system of Chicago

By the 1970s the investments in public transportation in Chicago started to decline. And then by the 1980s and the 1990s there was the general trend that people were moving out of the Chicago area, and public transportation is because of that in a downward spiral. So it was not worth investing in the public transit system of Chicago anymore. The problem in this is with regard to the equity issue is that it were especially in that era richer, white citizens who were leaving Chicago. And it is also tended to be middle class people who tended to leave the Chicago area. The people who depend the most on public transit in Chicago were not moving out of the city, these were poor people or lower income people. So they decided to disinvest in the system, conversing that the system was losing its base, it was not losing the base of poor people, but especially middle class people. So the investments in the system start to decline, the system starts to deteriorate. They are not expanding the system, they are actively taking out parts of the system. So, reducing the number of train stations, the number of bus routes.

By the 2000s the city pattern starts to change. What we see is that middle class and affluent people are moving back to the city, which means there is more preference again for public transportation. This might be because of environmental concerns or just to reduce stress. So, because of this there is reinvestment in the city, whether it is to maintain or reconstruct some of the stuff that has started to deteriorate. And now they are actually talking about expanding the system too. So, now we're talking about all these new activities, but we have always had this base of people who are transit dependent. And the new transit developments are mainly focused on creating new urban developments.

CTA Fundings

The city of Chicago and the CTA are trying to get the federal funds, because they see there is a transit renaissance going on. Precisely because transit preferences are changing, so they try to promote the system to a high skilled labour market, so they try to sell transit to the creative class. One part of this creative class concept is that these people make use of the public transport too, because of environmental reasons. So they try to attract this new group with new investments. Also, the city of Chicago is trying to invest in the blue line, especially among tourists, since this line runs from the O'Hare Airport to downtown. There is the express service which runs directly from the airport to the downtown, without local stops, just like the express train service in

Shanghai. So the airport can be integrated into the economic core of the city. So they are investing 300 million dollars in a downtown station, whereas this money is also needed to fund the red line extension for example.

This airport express service doesn't really come off the ground, partly because of the economic crisis, but also because they can't find a public private partnership. Because it is actually not going to be a profitable train. And the reason why it is not going to be profitable, is because we already have a train that services the airport from downtown. And even with this express train it is following the blue line almost exactly on the same exact track. So people will have to pay 30 dollars for an airport express ticket, whereas people can also just use the blue line for 2 dollars and 25 cents. Here is where it relates to your red line case, at the same time they invested 300 million dollars in this downtown station, which is never operative. Barrack Obama when he was a senator of Illinois and senator Jesse Jackson Jr. they get the red line extension added in the federal transportation bill. So now they can use 580 million federal dollars, but there still had to be money added from the city of Chicago, but because they spent 300 million dollars on this downtown station this is going to be difficult. And keep in mind that there is already a service to the airport. And of course on the south side there are people that have no immediate connection to the train. They have to travel to the train station to get there. So this is one of the equity issues, in which you can see how they kind of seeing transit as a part of their overall economic agenda, versus seeing it as a social good to connect to the public transit.

Red Line investment

In Chicago most new infrastructure is built with a public private partnership. So there has to be found a private partner to build the extension, and this party should want to operate the line. One of the things they were talking about, and this is actually an equity issue, how the private partner could charge an extra increment of a user fee for the train. So the train usually costs 2 dollars and 25 cents, so the private partner can charge the people an extra 50 cent after the 95th station. So the private partner can pay their expenses. So that people would have to 2 dollars and 75 dollars. This actually came in debate, because so many people were against this proposal and thought it was discriminative. That's how they think about what could be implemented as an instrument. Right now, they are still doing the environmental analysis. This is the first stage in realizing this project, actually the project is in the environmental analysis phase for thirty years now. The costs of the project have inflated to 1 or 1.2 billion dollar costs, this means the project has to go through a federal stage, the local part has to be matched by the city or the private partner.

Red line investment and equity

The poor people are right now not disconnected from transit, but it is just that they have a bigger burden on transit to get connected to the job center. They have to take multiple buses to get to the transit station. So they spent a longer time in transit, in this area there are also a lot of people with two part time jobs, so they have to travel between their jobs. So, the transit time really matters in terms of human developments, people would like to spend more time with their family instead of spending time in transit.

Congestion pricing and equity

So here is the thing about congestion pricing equity and public transport. If it were that the revenues of congestion pricing go to the transit system, that could do a lot to boost the transportation system. Especially when this money is used to expand the overall system. But there is no guarantee that these revenues will go to the public transit system. Another thing is that Chicago is pretty broke right now, in terms of that it has some serious debt issues, and I'm not convinced that they will use these revenues for public transit, I think they will use it for operational expenditures and not necessarily to use it for the public transit system. And that's where I do think it will expand the transportation inequity. It will shift the poor users to the lanes that are not congestion priced, so they have to spend even more time in their automobile. So lower incomes would have to spend more time in transport, whether it is on the highway or in public transit, when the red line is not being expanded because the revenues don't go to public transport. I think it is actually more important at this point about how they have been cutting the bus routes in order to shift resources to shore up the number of public trains they offer. So we have been cutting on buses, while buses are mainly the core of the public transport system and they particularly benefit poor people. But we have been cutting back the access to buses, also the frequency has been decreased for some buses. These additional waiting minutes are mostly added to poor people's transit times. And now they will also switch from the road because of the congestion pricing charge for riding a private automobile. In theory congestion pricing is not that bad, but in practice it will expand the inequity. When it is not possible to use the revenues from the congestion pricing for public transport then it is not going to add more equity to the system.

Kevin Manaugh

16/03/2016

Skype interview

Introduction

Kevin Manaugh is Assistant Professor at the Department of Geography at the Mc Gill University in Montreal. His main study objects are sustainable transportation, spatial justice and the decision making process in planning. For this interview we have agreed on a skype interview.

Equity and public transport

I think what's important from an equity perspective is public money. Public funds that go to public infrastructure, there's access to opportunities in many ways like access to jobs, health care and grocery stores, access to other people and society. It also provides people to participate in the society from an economic, social and health perspective. And I think what has changed a lot over the last few decades is the awareness that public transport systems aren't simply just to go faster than the roads, but it does actually mean access to those things and to create a healthy and happy live. My research is focused on to understand how cities implement these goals, like equal access and expanding access to socially disadvantaged people. So how this works out in the planning documents, and how their access actually is from a neighbourhood to these facilities.

Differences between cities

There is a certain consistency between cities, because all NPO's are required by title six of the civil rights act to pay attention in the infrastructure plans to certain social disadvantaged groups. However I think they are still in a sort of primitive stage when it comes to the use of certain indicators for equity. For example, Boston and San Francisco have very clear indicators based on income and minority groups. You have to acknowledge to measure such things over time, does it take longer for minority groups to commute? Do people from inner city areas have to make more transfers than people from suburban areas? It is important to measure these things over time. So therefore it is also important to see what indicators different cities are using.

Segregation and public transport

Yes, especially in regard of different racial groups living in certain areas. In Canada this is a bit trickier than in the US where there are a lot less clear cuts between the African American side of town and the white side of town. In Canada there is a lot more of a mix especially compared to some cities in the US south, or like Chicago. It makes it more clear to see injustices between different neighborhoods. In Canada this is trickier to do because there is not such a clear cut. We have been doing this analysis based on income, education levels and payment on housing costs and visible minority status. This is different for the Canadian and the US context. We have been able to capture with this analysis social disadvantaged groups in a broad way.

Different effects of infrastructure for direct and indirect equity

Yes, this can definitely have an effect on both aspects of equity, but I think vertical equity is more important in an American context where certain groups have been disadvantaged for many decades and they have not been prioritized in public policies and infrastructure spending, so it is

fair to target those groups that have been marginalized over time and so prioritizing those groups by increasing the funding, by increasing the service, is the right path to go on. In a rare case I would argue that horizontal equity would be a better goal, it depends on the needs, it might be better for a regional transportation plan.

Indicators to measure public transport

I think we wanted to capture something that relates to the Canadian specific variables. In the American context there are often indicators like income and different racial groups, which are less relevant in the Canadian context. And we wanted to find four variables that were correlated to one another. We not only wanted to capture aspects like wealth and income, but also access to employment, and we used the percentage of income spend on housing, which was a good way to see what could be spend on other things besides housing. We thought these were four good variables to see what the social disadvantaged groups are. Of course there are a lot of other indicators as well, since it is not all about income, but also your status in the country. It is true that in Canada there are lot of immigrants with higher education, which gives more nuance than just looking if there are people with an immigration status. In Canada there are two different systems, one is the point based education system, but Canada is also welcome to a lot of Syrian refugees, these are two completely different systems.

When we speak about equity it is also important to define what the different groups are, whether it is socially disadvantaged based on age, gender or disability status, there are a lot of different ways to see how equity is distributed. This can be very different for different cities, in Chicago the spatial distribution of income groups might be more important. So you might find different definitions of the groups that you want to observe. You might make different choices of the variables that will have a better connection to the actual and historical context of that city.

Red Line investment

I don't know that much about the Chicago case, but when there is a rail line connected to the poor side of the city that sounds like a good idea. It's interesting to look at it with a discourse of the justification of what's happening and who actually is being served. And to see how the accessibility changes and how the travel time changes.

P.S. Sriraj
University of Illinois Chicago
17/03/2016

Introduction

P.S. Sriraj is Interim Executive Director, Director of the Metropolitan Transportation Support Initiative (METSI) and Research Associate Professor at the Urban Transportation Center at the University of Illinois at Chicago. For this interview we have agreed on an appointment in the office of Mr. Sriraj at the University of Illinois Chicago.

Opinion on the red line extension

The demand goes as far south as 135th street and beyond. Currently the red line stops at 95th street. Does it make sense to extend the red line? That is a question of dollars and cents. Because is that the only way to make sure the mobility is unimpeded? Probably not. You can have a very good bus service that can feed into the red line. There is some there that can be improved. So then can be seen if it meets the mobility needs of that area. One thing about extending the red line is that the rail has a very significant impact in shaping urban form and economic development, opposite to the bus. So when you are talking about an area that is so poor, if you extend the red line to 130th street you immediately bring economic activity in the corridor, so that could be a good thing. So it's more a question of what you want to achieve. If it is just the mobility you can definitely put something together without the red line extension. But if the overall goal is to uplift the entire area then the red line extension is a good investment.

Indicators regarding equity and public transport

I have an index called transit dependency. There are households that are transit dependent, based on their profile. People that are over 65, children under 18, people who typically do not drive, people that have zero car households, those three are very important. On top of it from the environmental justice perspective, you also pay attention to low income households, tied to the thresholds of poverty guidelines. And then any minority representation, these are the ones that I put into the box of transit dependency people. So transit dependency should be part of the mix, otherwise you are providing public transit to a region that doesn't really need public transport. So target the research at the regions that absolutely need public transport.

Background red line extension

All I know is that the previous long range plan, GoTo 2040, the red line extension is in the physically constraint list of projects. The long range plan for a region has invites, all project ideas from the various stakeholders. They sort them and rank them, because the long range plan has a dependency on federal funding. What they do, and this is according to federal guidelines, they develop a smaller list of projects from the larger lists and prioritize those that will definitely be considered, even if the funding gets cut or reduced. The list of projects on that bucket get a more favorable look than the physically unconstrained. So these physically constraint projects have a certain agreement between stakeholders that these are important projects. So the red line extension is in the physically constraint list of projects, this puts it in a very good position. There is on paper enough support from the region for the project, they see it has an important project

in the region. From there on it is about the funding, if the CTA applies for funding they have to prove that all the goals are met, there has to be enough documented benefits, they have to do all the preliminary implementing, than it is tangible. And they also have to show that the region benefits from the project.

Other infrastructure projects in Chicago

The red line is the project that is on the table. There's been discussion about other projects, but nothing has progressed to the level that the red line extension has. It is the leader among these projects. There are some other projects by Metra and CTA, and some Pace buses projects. More and more people migrate to suburban locations who don't have a car, so more and more people from the suburbs have to be served by public transit, since not all poor people have cars.

Tim Welch

18/03/2016

Telephone interview

Introduction

Tim Welch is an Assistant Professor of City and Regional Planning at the Georgia Institute of Technology. He is an expert in the field of transportation & land use policy, planning & forecasting and freight. The last years his focus lies on the topics of equity and public transport. For this interview we have agreed on a telephone interview.

Public transport and equity

We have to change the way to look at what transit is. Our traditional approach looks at the distance to any transit service and usually we look at the frequency of service. So how many times does a bus come per day and how close are you to that. Those two things don't really mean much in terms of mobility and especially in terms of accessibility. So we're talking about someone who is low income, and when there is a bus that comes a couple of times, it doesn't mean this bus takes this person to his job or to the grocery store. In order to better plan for a more equitable transportation system we really need to look at how individual accessibility is affected by those measures. So are we actually bridging the mobility and accessibility gap for low income groups who are often clustered? And are their opportunities spread out of this area of low-income people?

Public transport and segregation

Transit has a really weird history with differences between low income and high income people. There are a lot of public transportation systems like here in Atlanta, where race and income play an important role. The early designs were more inclusive, with public transport going into the poor neighborhoods, to help the people in these neighborhoods to integrate in the environment. But by the time these systems were built they were built around the poor neighborhoods instead of into these poor neighborhoods. And the very wealthy neighborhoods completely rejected transit all together. So that the highest income jobs and the highest income housing is totally without transit usually. And the lowest income residential areas are also completely without transit. So if we're going to use transit as a bridge to reduce segregation, we have to look at where our transit systems actually take people. What neighborhoods they actually go into and start to lead out some of the political motivations. So, I think there is a possibility that they can reduce segregation, but they have to be redesigned or at least extended in a way that's more meaningful for lower income people. And higher income people need to have less of a voice in those projects and the lower income people should be brought to the table more often. It really takes both parties to have an equal voice, which is difficult, but there really are possibilities that transit can be a much better income bridge than it is now.

Vertical and horizontal equity

There is not one that is better than the other. There is no way to plan which is totally equitable. So the idea here is that we would give more transit to lower income people. And the vertical equity sense tries so. They have the biggest needs, so they need the most benefits. And then the higher incomes receive the least transit benefits. I don't know if that's fair or right either. I'm not

sure if horizontal or vertical equity makes sense from a planning perspective and total inclusivity or social justice perspective. These are just ways with which we can measure the effects of a transit system, but I don't know if they are the ideal for providing transit.

Indicators for equity in the public transport system

Ideally the indicators to measure equity will have a common index. Income is obviously an important one, as we know historically there is an important relationship between income and mobility. So income has different types, like household income or income per capita. You could look at the outcome of the transit system itself. We look at the quality of the transit system, so how fast is the transit, what are the opportunities of transit, employment can also be an important indicator. So, what is the percentage in a neighbourhood of total unemployment. And then you have to look at the job opportunities at the origin and the destination and how they match to the skill level of each individual. In that way you are getting at the idea that transit is going to be the tool that brings people to their jobs. And when they can get to their jobs they can go shopping and participate in social activities.

Differences between cities in measuring equity

It depends, not every city has high-speed transit, not every city has a rail system. So in theory, there are all different contexts. So a bus can do just as good for some people as a heavy rail system. So it could be different from city to city, but if we're looking at local counties it is much different than when we look at the federal funded systems. Then you need something that is pretty objective. So one measure that can be applied to every transit system in such a way that we can see how effective our federal transit dollars are and doing whatever it is we're trying to accomplish. One of the things that we're working on is trying to get this measure that we have as a measure that we can apply in every state. We're not sure how that's going to look in the end, how comparable cities are going to be and how meaningful that comparison is going to be, I think you need one that looks at the federal fundings and one with a more local focus.

Sonali Tandon

Chicago Transit Authority

14/04/2016

Chicago Transit Authority Headquarters

Introduction

Sonali Tandon is working on equity issues in regard of the Chicago Public Transportation system. She is involved in the equity issues of the red line extension, on which this interview is focused. The location of the interview is the headquarters of the CTA. It was not allowed to record the interview, therefore this report is based on notes during the interview. The purpose of this interview is to get more insight in the planning process behind the red line extension, and the view of the operator of the Chicago Transit Authority on equity in public transport.

Background of the red line extension

The planning process of the red line extension started in the 1949, but has been postponed for a few decades until 2006. The original design was set to be built along the I-94, but was initially not built. Whereas other lines in Chicago were extended over a longer distance, for example the orange line was built until Midway Airport. In the last decades there was not enough money to think about building new lines or extending lines. The money had to be used to maintain the existing infrastructure. In the 1990s there even was a federal law which stated that no other new infrastructure projects were possible. In the early 00's a few other lines have also been proposed to extend, but the red line was prioritized this time.

In 2006, the planning process started again. First, alternative routes had to be considered for the proposed route of the red line extension. After the route has been determined, there was time for public comments on the red line extension. Also, a quantitative analysis of the impact of the red line extension has been executed. The locally preferred alternative has been adopted in 2009. It has been determined that the federal funding makes up 50 percent of the projects funding and so 50 percent has to come from local sources. For safety reasons the eventual track has to be 50 feet away from the original track. The environmental process for the red line extension also takes a long time.

The first part of the track of the extension is especially a residential area. Closer to 130th street the area is mainly industrial. There is also a lot of public housing close to 130th street. There has been debate to shift the alignment to Halsted street, which is a commercial corridor, more to the west. But there was no public interest for this alignment.

According to Tandon there is already a very good bus service in the far south side of Chicago. Although the main problem is that there is a lot of transfer at 95th street. The red line extension will be able to serve more demand for public transportation in this area. The bus rapid transit at the moment is not fast enough, because it has not enough right of way. In the area of the red line extension there are some jobs, but most people have to commute to other parts of the city.

The red line extension aims to help the low-income people in this area, therefore an equity analysis is an important aspect of this project, to make sure it will also actually benefit the low

income people. There has been a big population decline in the area of the red line extension, therefore the funding may decline. There have been some ridership projections for the CTA, but the last one has been done in 2000. So this has to be done again. According to the Federal Transit administration there is a criteria for transit dependent people living in an area, when an equity analysis is being done. The federal funding for the project is not yet sure, this is crucial for the feasibility of the project. There is political willingness in Chicago for the project.

According to Tandon, transit dependent people consist of seniors, people with disabilities and poor people. There are some other projects close to the red line extension, which will help to improve the transit situation in the south side of Chicago, like the Expressway Bus Rapid Transit and Ashland Bus Rapid Transit.

Interview CMAP equity

Claire Bozic & Jacky Grimshaw

Chicago Metropolitan Agency for Planning

18/04/2016

Interview at the CMAP office (Willis Tower)

Introduction

Claire Bozic and Jacky Grimshaw are both working on transportation issues in the city of Chicago. For this interview we have agreed on an interview in the Willis Tower, the headquarters of the Chicago Metropolitan Agency for Planning.

The role of CMAP in equity issues

We don't have a real continuous equity process, but when we do our long term transportation plan, we do have to consider the effects of equity and we do look at it and project studies generally include an equity analysis. Now CMAP doesn't always work on the project studies, consultants work on the project studies, but we provide them with information for their analysis. And mainly our requirements are to look at the equity impacts, and it is for our transportation planning process. And then as a broader policy goal, we are in the phase of making our next long-range plan on to 2050. And this report follows the report on to 2040. So there's not a lot of explicit equity policy language in there. We didn't do as much as we might have in the last go to 2040 plan on equity impacts. It wasn't our main focus, but we want to make this much more robust in the go to 2050 plan. So we're exploring many different ways to highlight that in the next plan. The general project title of that is inclusive growth and we'll be creating a strategy for that towards the end of this year. This strategy will highlight some higher level policies that CMAP can approach to create a more inclusive region and that will be across cutting many different topics and not just transportation.

Equity situation in Chicago in the last decades

First I think it is important to look at equity in terms of a lot of populations, so you have people with disabilities, you have seniors who are not able to drive anymore and live in places without public transportation, then we have low-income people and people of minority incomes. I think when you look at the distribution of transit in general you will find that the areas that we traditionally think of urban low income in minority areas are very well served with transit. That's always surprising people when you do some kind of a transit analysis or transit access analysis. Like, hey we have this vision of these neighborhoods being underserved but in fact in terms of public transportation they are very well served. The places where you can find places where low income people live that isn't as high as it might be are some older suburban areas that have changed demographically over time and maybe they are more suburban type areas but they have a lot of minority and low income people. So older areas in the suburbs. I think when you compare suburban accessibility anywhere in the city it is going to have a higher presence of density on places where there are a lot of public transportation options. It is also about you are measuring it. I think when you look at the presence of high quality transportation options, you see that it is present in a lot of places in the city or cook county and not necessarily in some of those

suburban communities. But I think a more layered approach requires you to look at those linkages between the presence of the bus or rail service and where it takes you. So does it take you to your job or to public facilities? It is not just about creating a map and say 'O there are transportation options here'. But it is about the connection with the activity centres and that is kind of another layer. Some people think of transit only as rail, but we have a complete bus coverage all over the region, but the truth is, it is slow. Buses are stuck in traffic, we don't have a bus rapid transit system, and hopefully we will be getting some. So when you are not going to downtown the traffic is generally slower. So I think it is important to look at job type, so not just where the jobs are, but when you are looking at a certain population where the jobs match a certain qualification. There are a lot of job types which are not in the downtown area, but for example in the Midway or O'Hare area. There is transit in the city but it doesn't necessarily connect the job clusters with the residential areas.

Equity in Chicago compared with other cities

RTA has a report which compares our system performance to other cities, so that would be more of their required role. And this report is probably available. And as far as a broader question, it is important to compare this with how other regions perform. And so as a part of this inclusive growth topic that I mentioned, which looks how the region can be more inclusive, we've done an overview of other NPO's and to look at how they adapt equity in their plans and policies.

Similar projects like the red line extension

The red line is obviously our major trunk, as far as capacity the red line project is huge. When you are starting at no service and then add transit service, that is a huge increase. It is a question of scale, for a region that has a pretty dense built transit system, it is hard to have a single investment that creates a huge increase in equity, because it is all incremental. The red line extension is mostly making people's bus ride shorter. Instead of taking the bus all the way to 95th street you can now take the bus to 130th street. There are some operational issues, because at 95th street there is bus congestion and it takes a lot of time for buses to get in and out. It is going to be more efficient, a lot of the ridership comes from people who already taking transit now, and they will still be riding transit. Their ride will be improved, but not as much as for people who didn't use transit before at all. Bus service provides more coverage of the region than rail service and more ridership. So I think the red line south extension report highlights this, but it is also the connection of quality bus service once you get off the red line. Is the bus service 24 hours? And that is going to be an issue whether it is going to be expanded or not.

I think you run into the problem of the people who are doing the analysis of the service, and say that there is a good peak hour service, they have to keep in mind the lives of people who are working different hours and different types of jobs, they don't have the same schedule. So those kind of issues are really important for the transportation planners to keep in mind.

Then there is the project of the Ashland bus rapid transit corridor. They are looking at creating a bus rapid transit lane on this north south corridor which runs pretty much parallel to the red line train. And that would be a big capacity and quality of service addition. Then there is also the Pace Bus Rapid Transit on the expressways that will be able to use the congestion pricing lanes. So now we have the Pace Bus lane on the shoulder of I-55. And they are also looking at that for the I-90 on the north side. And of course they go off the expressway to pick up passengers and then go on the expressways again. So that is our expressway BRT system that is starting to develop.

The city of Chicago has been studying a bus rapid transit system. So having one BRT route is fine, but it will work much better when it also connects East-West routes. There are always arguments against the BRT lanes, like what happens when you take a regular lane and make it a BRT lane, or what happens when you interfere with parking. It makes it harder to get to people's houses on Ashland Avenue because you are not allowed to make certain turns anymore.

Goals of the red line extension

The main goals are to achieve the six federal goals. So, to the extent of whether it is the most transit dependent region? I don't know. You can certainly use this data and find out yourself. How many people are zero car households, or how many people are disabled. As far as transit mode it was pretty much a similar transit share as the city itself for the area of the red line extension. But when you compare it to the region it is totally different. An interesting finding from their report is that there is also a higher driver share in the red line area. Another interesting finding when it comes to equity, is that even low income people can get a job they can afford to buy a car for, then they do that. And that really improves your access to a lot of things, besides going to work. So looking at accessibility to the suburbs would be an interesting component. CMAP helps creating a lot of accessibility maps, with access to jobs and education facilities for example and the change that the red line extension can bring to this accessibility. The interesting thing that I found out recently is that the University of Wisconsin takes a different approach to the accessibility issue. They say that it doesn't matter how many jobs or schools are within 45 minutes, it matters if there is one within 5 minutes. So they have done a decay weighted job accessibility analysis. And back to the point of the job types, it is also important to see where certain kind of jobs are located.

You said something in your thesis about congestion pricing and funding, and I don't really agree on that point since congestion pricing is really about reliability and not so much about funding. And that's also important when it comes to switching from bus to rail: How reliable are the buses? Part of the reason why buses take so long is that they are stuck in traffic and two is that they are unreliable when it comes to travel time, because you never know what happens in traffic. So the red line gives reliability, in the same way that congestion pricing gives reliability. And the same with the BRT service, you are not only selling faster service, but especially important is reliability. For a lot of people reliability is more important than the average travel time. So that's why you should take into account these 95th percent travel times. What happens when you miss your connection and then you have to wait for it. Another source of commute patterns data is the census LIAD data that gives you commute patterns of where workers live and where they work. And now they just came out with the census transportation planning package. You can also have a look at changing commute patterns over time.

There are enhancements to transit, if you allow for example the Pace bus service to use the congestion priced lane for free. So as far as paying the project it has to be seen project by project. They always say that Pace buses can use the congestion priced lane for free but the people in the bus still have to pay a fee, you could certainly make this fee less. You said in your thesis that a congestion priced lane would be owned by a private organization, but that is not necessarily true. You should provide alternative modes of transport to people who can't afford to pay the congestion priced toll. We definitely think that should happen. All those contracts for congestion

pricing lanes are really variable, there are a lot of different options. So the role of the private entity can be very different. So we just can't say right now if the revenues of congestion pricing can be used for public transit, since it has to be written down in the contracts. But as far as benefits generally to public transportation, it is that allowance of the existing bus routes to use the lane and new bus routes. New facilities to support the bus routes, so new bus stops etc.

Shifting transport modes due to congestion pricing

Yes, it has been shown that if you go look at Pace its website and see the bus on shoulders page. It has been grown with 400 percent, but the ridership on the Pace buses is not so high. But I think over time, because right now on I-55 you can only use the shoulder with Pace buses, but right now they cannot drive the full speed on the shoulder, but on a congestion priced lane they are able to drive faster. The magnitude is important when it comes to change of transport mode, because there will only be a big effect in the long run. In southern California there are variable priced congestion priced lanes, as far as how it can adapt to the induced demand. And right now the option is a new lane, so this also a federal restriction to price a new lane. And this added lane will give more capacity. So if you are using federal funds it has to be a new lane.

Interview CNT

Jacky Grimshaw

Center for Neighborhood and Technology

18/04/2016

Interview at Center for Neighborhood and Technology

Introduction

Jacky Grimshaw is vice president for policy at the CNT. She joined CNT in 1992, and has since developed its capacity to engage in public policy advocacy and transportation planning. She has advocated for and provided expertise to increase transit in the Chicago region. The main goal of the CNT is to improve the cities' economic and environmental sustainability.

Background of the CNT

I manage the transportation and community development program. When the CNT was first created it came out of an experience of Christian action ministries on the West side of Chicago. That was a low-income community that had and still is experiencing disinvestment, it was a community that was suffering from food deserts. Most of the food that was available came from corner stores and liquor stores, but this was mostly canned food and stuff like that. So the existence of CNT came out of communities that dealt with disinvestment, and we kept that focus in our 40 years of existence. We are focused on urban areas with a particular interest in lower and middle incomes. We are trying to create tools and strategies for these communities. That is the link between the CNT and equity.

So in the area of transportation our focus is on the low income people, for them it is extremely expensive to own a vehicle. So they need alternative modes of transportation. So how do we expand transit and bike facilities and improve sidewalks? The work that we do in some way addresses these issues. Alternative modes of getting around other than the automobile. Our most recent project around transit is that the regional transportation agency had identified a number of transportation projects to put in the long term plan. But there was not enough money to build them all. There were some projects that were aimed at improving mobility for low income people, but they didn't get any funding. So we started a campaign to make sure these projects were built after all with a social funding. One of them is the red line extension, this line was promised to the folks in Roseland back in 1968. Almost fifty years we still don't have that expansion. All of the other transit lines we have, the red line north, the blue line, orange line, the green line west. They all go to the edge of the city, but the red line south does not. The community of the red line south is a low income minority community with a lot of unemployment, high poverty rates etc. Without having the ability to own and operate a vehicle, they don't have the access to jobs, so they are actually disconnected from the economy. Another project is the gold line. This is the expansion of the Metra Electric, but it operates on commuter rail frequencies, so unless you travel at rush hour it is not accessible for people who live on the southeast side. The gold line would operate at CTA frequencies so people of all shifts have access to jobs and a reasonable travel time period. The off peak is two hours between trains sometimes, so it would be inefficient for everyone who has to be somewhere on time. So that's another way of getting more transit for poor people at the south and southeast side of the city.

Red line extension

The thing is that the red line has been going on for a while, we participated by research being done by the UIC for the community looking at what are the benefits of having transit, etc. That was done and completed four/five years ago. We did that and use it when necessary if there are questions asked. At this point of time we don't have to do anything else on the equity issue, because it has already been established. It is in the pipeline, but in the lower level of funding. So that argument we don't have to make anymore that's been made. We now have to move it up in the funding priority level, so if there are funds available, the red line extension is in the top. I probably have a report, but it was done by the UIC, it's probably online and in fact I think there is a community that has been really advocating for the red line extension and they had it on their website. CMAP did a little video on their website for the red line extension, but if you can't get it online you can get the report from me. The advantage of the red line is the long hold system route in the system. At the Evanston border you can connect to the cook county suburbs in the north. But for people on the south side it is very important to have this same connection to the loop. When you see the maps of where jobs are and where they are unemployed and their inability by transit to get there. By bus it takes two hours to get there. An efficient way of getting to these jobs is vital. The red line extension gives the connection to the blue line to O'Hare. It really provides more efficient ways to get people where the jobs are.

Vertical and horizontal equity

Well, they are very different goals. In terms of our environmental goals, having more transit for everyone is definitely something to go for. In terms of equity, it is important for people who don't have access to jobs to have access. It depends on what the goals are, transit is important for everyone, but in particular having access for people who are unemployment is the ultimate goal.

Transit Oriented Development

Another thing regarding equity and transportation is transit oriented development. It becomes a gentrifying tool. People who live along the rail lines are pushed out and then the properties are redeveloped for higher incomes families. We started a project to maintain affordability for lower and middle incomes at transit stations. So they have a convenient and efficient way to where they need to go. Now they are being pushed off by richer people. How do we maintain affordability for people who lived in communities forever, people who benefit from living close to transit. Right now those communities are seen as almost not part of Chicago, so I don't think people are going to develop the red line extension neighborhood. There is a controversy that existing buildings are being torn down at Logan Square, empty lots of stores are being torn down in favor of higher priced units. It is not so much the new lines but the existing lines where transit oriented development takes place. The blue line has tremendous access for people, so folks who have higher means are moving into these neighborhoods. The Hispanic and Polish working class people are being forced out by the higher incomes.

Equity and congestion pricing

The thing is that I know where congestion pricing has been introduced like the I35 in Minneapolis, that there were combinations made for lower income drivers, there was a combination to not charge the low income people as much as other folks. With the current technology it is not difficult, with transponders you can make the payment which is linked to an

account where the income is displayed. So this low income strategy is not that difficult to do. I don't think congestion pricing and equity is as much of a problem now as when it is started. I'm in favor of congestion pricing where there are alternative modes, like the Kennedy expressway. There it would work perfect because of the blue line and metra going on the same transport link. So I'm a fan of congestion pricing for that reason and again because of the environmental impact, because all of the pollution. So that's my opinion. Well, see right now on the toll road there is a differential in pricing not so much on equity but in terms of cars vs trucks, so you pay a different rate to drive on the tollway. So the thing is that if I would market it is that because of congestion pricing there will be less traffic, so there is more room for the richer people. And by moderating the costs you can achieve that. If you see the number of low income people who own cars, it is not that high. So percentage wise it is not a lot of people, they already do a lot of carpooling. And I think that it is a false argument. I mean so these people are going to complain because of the tax system, so I pay the maximum percentage and they pay less. I think people are used to accommodating and understanding that some people are better off than other folks. As a high income driver you have less people to compete with, so just be happy.

You got to use the revenues from congestion pricing for public transport. So when congestion pricing is implemented on the Kennedy, this money can be used to build the red line. Because these people use the Dan Ryan parallel to the red line and then goes to the Kennedy. When there are more options for connectivity there is less reason to be on the road. In places where congestion pricing has been implemented it is proved that people shift modes. The higher income folks want to be in their car still, and the cost is not a big thing to them. Someone who is making minimum wage, and when they can shift modes, they will do it. Even middle income folks might make this decision. The cost of maintenance, insurance and congestion pricing might become too high compared to using transit. People make reasonable decisions.

Important indicators in measuring equity in public transport

I think the cost of transport, the routes and frequency. Again when the metra electric runs only once in two hours it is not really useful. So costs, routes, frequency, connection to employment centers. I think those are the main performance measures I would use. Well, you know back to your question about availability for all. In a place like Chicago that has very segregated housing areas, where low income communities are identified very easily. But they live all over the city. So having a good transit system supports the low income people in Logan square, which is not considered a low income community, they need as much access to transit as people who are concentrated in the low income communities. That's why having a region wide efficient transportation system is important for equity, to provide transit for everyone in the region. We talked about the red line extension which goes to the edge of the city. The southern suburbs also lacks an efficient transit future. A new project is a new rail line that connects the south suburban areas to downtown Chicago. We have to look at in terms of region equity issues not just in the city but also in the surrounding suburbs. There are buses that will feed into the red line, people on the south side can get onto the Pace buses and they can get quicker to the red line than right now. The red line will help suburban folks, but a direct train line from the suburbs to downtown will also help. We just have to get Metra to run at a higher frequency, that's the point. Right now it suits the nine to five people but not the second and third shifts.