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The knowledge problem of public transport policy

ERIK JOHANSSON

FACULTY OF ENGINEERING | LUND UNIVERSITY 2020



The knowledge problem of public transport policy

The knowledge problem of public transport policy

Erik Johansson



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DOCTORAL DISSERTATION

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Abstract <p>The overall aim of the thesis is to investigate the knowledge problem in regional public transport planning. The knowledge problem is twofold. How do transport policy arrive at the desirable actions they take and how do they assess the alternatives, and what can we say about the contributions of already implemented transport schemes. Paper 1 explores how policy objectives in regional public transport are translated into action and to investigate how public transport measures are evaluated. Paper 2 presents a case study of Spårväg syd, a light rail project in Stockholm, with the ambition to understand the use of appraisal tools and discuss how these can be improved. Paper 3 investigates the links between accessibility, as well as the composition of accessibility and real estate values. Paper 4 analyses the causal effect of a train station on local labour income among current residents as well as the labour income of the residents that the place attracts. Finally, paper 5 explores the association between the accessibility that train stations provide and local labour income more broadly across Sweden. For paper 1, the results indicate that decision-makers ask for knowledge on ongoing trends such as patronage and market share in relation to all motorized transport, an increased interest in understanding the impacts of transport on society, the strategies of PT are connected to long term regional ambitions. Paper 2 highlights that particular projects are tightly connected to long term ambitions. Spårväg syd was on the agenda long before a formal cost-benefit analysis was conducted. The project is also tightly connected to political goals of land-use development. The findings from paper 3 reinforce the evidence that real estate values are positively associated with accessibility. Also, the paper finds that the composition of accessibility, namely the degree to which the accessibility is built up by one or several modes of transport, is positively associated to real estate values as well. The policy implication of this finding is that transport appraisal could add assessments not only of marginal accessibility changes, but also the marginal change in the composition of accessibility. The results from paper 4 indicate an absence of a causal link between train stations on local labour income. Both in terms of the longitudinal analysis and the spatial sorting analysis. For paper 5, accessibility through the national railway network was found to be associated with local labour incomes. The thesis increases the evidence of effects of transport on income and real estate prices. Moreover, the thesis concludes that regional public transport planning seems to be subject to different motivations and trade-offs depending on project and context, which complicates the seeking for a universal appraisal procedure.</p>		
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MADE IN SWEDEN 

To my grandparents

Table of contents

Populärvetenskaplig sammanfattning	11
Acknowledgements	13
1 Introduction	15
Previous research	17
Transport impacts	17
Approaches to appraisal and evaluation	19
Concluding remarks.....	22
Transport planning in Sweden.....	22
Thesis structure	23
2 Aim	25
The papers and the progression of the thesis.....	26
3 Framework.....	27
Economics and decision-making.....	27
Economics and the CBA	28
Decision-making.....	30
Spatial implications of transport	34
Accessibility	34
Spatial economics.....	36
Conclusion of the framework.....	38
4 Methods and data materials	39
Qualitative methods	39
Epistemological position	40
Practical interview issues	41
Documents.....	42
Quantitative methods	43
Hedonic regression	43
Difference-in-differences	44
Panel models.....	45
5 Findings.....	49
Paper 1. The explorative study	49

	Aim.....	49
	Findings	49
	Paper 2. The case-study.....	50
	Aim.....	50
	Findings	51
	Paper 3. An implication of uncertainty	51
	Aim.....	51
	Findings	52
	Paper 4. Focus on causality	52
	Aim.....	52
	Findings	53
	Paper 5. The railway network and labour market outcomes	54
	Aim.....	54
	Findings	54
6	Discussion.....	55
	What are the tasks of regional public transport, and how is it thought to contribute to societal goals?	55
	How are the strategic goals of regional public transport guiding the use of appraisal?	57
	How can accessibility be defined and analysed in a regional public transport setting?	59
	What is the relationship between accessibility and economic indicators?	61
7	Conclusions	63
	Contribution of the thesis	64
	Further research.....	65
	References	67
	Appendix	81
	Interview guide paper 1	81
	Interview guide paper 2	81
	List of included papers	83
	Declaration of contribution.....	83

Populärvetenskaplig sammanfattning

Avhandlingen studerar vilka typer av kunskapsunderlag som används och efterfrågas före beslut om kollektivtrafikåtgärder och vad vi kan lära oss efter. Detta är ett område som ofta gett upphov till diskussioner, i synnerhet de större projekt som varit aktuella i Sverige på senare år, t ex Västlänken i Göteborg. Även allmänna diskussioner om hur subventionerad kollektivtrafik kan påverka t.ex. arbetsmarknaders storlek och funktion är vanligt förekommande. Avhandlingen består av fem artiklar där planering av regional kollektivtrafik behandlas i två artiklar och kollektivtrafikens effekter på ekonomiska indikatorer behandlas i tre artiklar.

Artikel 1 kommer fram till att kollektivtrafikplanerare håller sig till så enkla analyser som möjligt i den löpande planeringen, medan större projekt drar till sig större utredningsresurser. Slutsatserna pekar också på att kollektivtrafikplaneringen inte nödvändigtvis har generellt förbättrad tillgänglighet i sikte. Istället kretsar ambitionerna kring att förmå resenärer att resa kollektivt snarare än med bil, erbjuda kollektivtrafik även där resandevolymer är låga, och använda kollektivtrafik i ett strukturerande syfte när nya stadsdelar planeras.

Den samhällsekonomiska kalkylen tenderar att vara frånvarande i den löpande kollektivtrafikplaneringen som istället utgår ifrån nyckeltal angående intäkter, utgifter och marknadsandelar av trafiken. Detta innebär dock inte att planerare inte bryr sig om samhällets nytta av trafiken. Tvärtom menar intervjuade kollektivtrafikplanerare att betoningen på kollektivtrafikens roll i samhället ökat under det senaste decenniet. Men vad som är samhällets intresse har inget självklart svar, vilket denna avhandling diskuterar.

Skillnaden mellan regionerna vad gäller resurser och kompetens är stor. Trafikförvaltningen i Region Stockholm utgör en större organisation än kollektivtrafikmyndigheterna i mindre regioner. Kompetensen beror också på vilka typer av projekt som myndigheterna ansvarar för. Mindre kollektivtrafikmyndigheter ansvarar inte för fysisk infrastruktur; det gör Trafikverket och kommuner. Region Stockholm däremot omhändertar just denna typ av projekt inom ramen för ansvaret för den regionala utvecklingen.

De kunskapsunderlag som Region Stockholm använder studerades närmare i artikel 2 om projektet Spårväg syd. Detta är ett intressant projekt då en social konsekvensbeskrivning (SKB) utreddes för att försöka ge en bild av konsekvenser som kan missas i en samhällsekonomisk analys. En slutsats som vi drar av studien

är att SKBn, liksom övriga utredningar i projektet, har ett fokus på spårvägsalternativet. Frågan om alternativa projektförslag skulle kunna resultera i motsvarande sociala konsekvenser lämnas till stor del obesvarad. Däremot är SKB ett intressant komplement till en samhällsekonomisk analys som kan utvecklas.

I avhandlingens kvantitativt analytiska del behandlas ett orsaksmässigt samband mellan nya pendeltågsstationer i Skåne och lokala lönenivåer. Artikel 4 kommer fram till att järnvägsinfrastruktur i form av nya pendeltågsstationer i Skåne mellan åren 1996 och 2001 inte hade någon orsaksmässig effekt på lokala lönenivåer.

Artikel 5 finner dock att det finns ett svagt positivt samband mellan individers tillgänglighet till arbetsplatser, via Sveriges järnvägsnät, och lokala lönenivåer. Det är med andra ord viktigt påminna om skillnaden mellan korrelation och kausalitet. Sambandet mellan tillgänglighet och löneinkomster är sedan tidigare etablerat, men den kausala effekten som orsakas av enskilda åtgärder är mindre känd och bör inte tas som given. Även sambandet mellan tillgänglighet och fastighetsvärden är sedan tidigare väl känt. Denna avhandling bidrar även till empiriska bevis för att fastighetspriser är högre där flera transportmedel bidrar jämnt till tillgängligheten jämfört med platser där ett färdmedel dominerar tillgängligheten, allt annat lika.

Avhandlingen drar slutsatsen att planering av kollektivtrafik styrs av tre generella motiv, med reservation för att det kan finnas fler. Det första motivet är transport för starka stråk. Det andra motivet är transport för glesbygd och som en sorts samhällsservice. Det tredje motivet handlar om att strukturera framtida markanvändning.

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Erik Johansson

Lund, 8 August 2020

1 Introduction

“Gothenburg is a clean airy town, and having been built by the Dutch, has canals running through each street, and in some of them there are rows of trees that would render it very pleasant were it not for the pavement, which is intolerably bad.”

Urban infrastructure was noteworthy and essential in 1795 when Mary Wollstonecraft (1987, p. 72) wrote these lines, and not much has changed since in that respect. Transport is in many ways a prerequisite of much of our everyday lives. Human action is dependent on the possibility to reach activities, whether it is work or school, grocery stores or shops.

Transport systems help to bridge distances and play a central role in securing accessibility for people and businesses. Much effort of transport policy has been devoted to increasing the distance that we can traverse within a given unit of time. But transport has also increasingly become a problem source with its emissions, noise and congestion, and thus reducing the well-being of individuals now and in the future. Transport researchers have argued that encouraging modal shifts, to create a balance between streets as movement and place, and encourage mixed land use are three central topics for transport policy (Banister, 2011).

Transport and other phenomena that are location-specific, such as labour and housing markets, are tightly connected. Housing markets in rural areas are different from housing markets in urban areas, and one reason for this is that labour markets are generally thicker in urban areas, which partly is explained by variations in accessibility through transport. Thicker labour markets mean that there are a wider variety and more substantial quantity of jobs and firms in cities.

The accumulated knowledge on the impacts of transport on, for example, the labour market is continuously growing. However, causal effects are context-dependent, and it is, therefore, difficult to establish universal order of magnitudes of these relationships. This thesis approaches the issue of what knowledge we can establish after the fact. This is crucial, because “after the fact” much of what we observe appears to be results of given policy action. A possible risk is that policy-makers neglect the potential counterfactual unfolding of events, which Bastiat (1995) elegantly described already in the mid-1800s with the essay “What is seen and what is not seen”.

Another problem that this thesis aims to address is the planning and decision-making of transport infrastructure and other transport measures. This problem

consists of the obtainment and assessment of knowledge before a decision. Economists have over the last century developed methods for aiding decision-making, but the welfare economic doctrine, and its practice in transport economics, has met criticism for its technocracy (Hultén, 2012; Thoresson, 2011). Alfred Marshall, one of the most influential economists of all times, argued in the preface to his *Principles of Economics* that there is a risk of being too absolute in economic analysis (Marshall, 1920):

“The more simple and absolute an economic doctrine is, the greater will be the confusion which it brings into attempts to apply economic doctrines to practice, if the dividing lines to which it refers cannot be found in real life.”

This thesis (from here on referred to as *the thesis*) is an attempt to understand the practice of public transport planning and examine outcomes of transport provision. The aim is *to investigate the knowledge problem in regional public transport planning in order to increase the general understanding of appraisal and evaluation of public transport and contribute with empirical observations on public transport planning and effects of transport accessibility in Sweden.*

Transport planning is increasingly a part of broader government planning. Public transport is perceived to be essential to achieve economic and environmental goals among Swedish local and regional authorities (Stjernborg & Mattisson, 2016). Sweden’s national transport policy document states that it is “important to put the transport system in its context and that the planning of [transport] development is coordinated with other societal planning” (Prop. 2008/09:93, p. 59). Another example is the title of the UK White Paper on transport: “Creating Growth, Cutting Carbon” (Department for Transport, 2011). In terms of transport policy, public transport is often highlighted as a means of reducing levels of car use and achieving sustainable modal shifts (Banister, 2008).

The ambition with this cover essay, beyond connecting and summarising the five papers of the thesis, is to try to conceptualise the knowledge problem of transport policy. Economists have, together with engineers, established a rigid framework for assessing public policy in the form of cost-benefit analysis (CBA). While it rests on a sound economic foundation, the problem arises in the mainstream CBA method and its normative claims. The CBA of a proposal is often communicated by a single number that is thought to represent society’s valuation. The thesis finds that decision-makers cannot sensibly interpret that number, and there is a looming question as to whether it is at all possible to apprehend society in a single number. Instead, models could be used to illuminate the problem and its trade-offs. Computers can help us structure the problem, but humans are better in coping with “radical uncertainty” (Kay & King, 2020).

Previous research

This section introduces literature from the last few decades on topics that bear relevance for the thesis. Impacts of transport and approaches to appraisal are the main themes, and most references come from economics. Still, the economic literature is contrasted with critiques and ideas from contiguous fields. While I do not intend to do a complete survey, this section aims to recognise a variety of perspectives in transport research.

Transport impacts

Public transport is gaining increasing interest, and researchers from different academic disciplines are claiming a diverse set of possible outcomes and impacts. The scientific problem is to find general conclusions regarding the links between transport and society as a whole. What does the literature say about the outcomes of transport? The primary outcome of transport are the benefits within the transport system itself (Banister & Thurstain-Goodwin, 2011), i.e. accessibility is the principal outcome that transport authorities work for (van Wee, 2016). Beyond this, previous research has analysed the links between accessibility and e.g. the labour and housing market, introduced below. Researchers have also claimed that long-term sustainability targets may require more attention (Banister, 2008). Moreover, there is a concern about how well appraisal practice takes equity and justice into account (Pereira et al., 2017).

What is “wider economic impacts”?

Besides changes in travel time, traffic safety, in-vehicle crowding in public transport, health and carbon emissions, wider economic impacts (WEI) have been of major interest lately (Laird & Venables, 2017; Lakshmanan, 2011; Peter Mackie et al., 2014). The WEIs are commonly defined as impacts beyond what is captured by the user benefits (Holmgren & Merkel, 2017). That is to say, if any market is imperfect (in welfare economic terms), there are WEIs (Wangsness et al., 2017). These potential WEIs differ between urban and inter-urban schemes (Laird & Venables, 2017), and rural schemes (Laird & Mackie, 2014). We are looking into approaches to appraisal below, where we note that there is a significant risk of double counting when adding impacts on top of each other without considering what “wider” means.

Productivity and employment

A big reason why urban and rural schemes differ is that in urban contexts there are potential agglomeration effects, a term which represents the density of workers, firms and industries within a city (Chatman & Noland, 2011). Previous research has

found evidence of a positive correlation between the mass of skilled workers and firms in high-tech on the one hand and productivity on the other (Ciccone & Hall, 1996; Combes et al., 2012; Combes & Gobillon, 2015; Henderson, 2007; Melo et al., 2017). Yet, it is unclear to what extent transport investments have a causal impact on this (Chatman & Noland, 2011; Graham & van Dender, 2011; Melo et al., 2013). Further, Melo et al. (2017) found that the majority of the productivity effects in US metropolitan areas occur within the first 20 minutes of travel time and drops sharply after that. This result indicates a non-linear relationship between accessibility and productivity.

Changes in accessibility can also impact employment (Gutiérrez-i-Puigarnau & van Ommeren, 2015; Johnson et al., 2017; Norman et al., 2017). Norman, Börjesson and Anderstig (2017) found that accessibility has a negative influence on unemployment, and the elasticity is largest for lower educated. Gutiérrez-i-Puigarnau and van Ommeren (2015) found that increased commuting cost had no negative impact on labour supply.

Like productivity, the impacts of accessibility on commuting are found to be non-linear (Johansson et al., 2003), and 45 minutes commuting time appeared to be a point when moving becomes more appealing than commuting according to a study in Beijing (Huang et al., 2018). Studies use decay functions to take into account how, say, jobs at certain commuting times contribute to accessibility (Beria et al., 2017; Duranton & Puga, 2004; Reggiani et al., 2011).

Property values and option value

Land and property values are positively associated with accessibility (Ahlfeldt et al., 2015; Debrezion et al., 2007; Mohammad et al., 2013). It is common to use properties to reveal the value of accessibility since properties absorb the value of a location. It would, therefore, be the definition of double-counting to add it twice.

A related topic to the value of a location, but not yet fully understood, is the idea of option value. It is rooted in uncertainty, and is defined as a value for having a service available for potential future use, even if actual use is never realised (Laird et al., 2009; Lindsay, 1969; Weisbrod, 1964). The literature is, however, fragmented in terms of definitions and method. Definition tends to be based ad-hoc, and taxonomies of the use values and non-use values thus differ from study to study (Carson et al., 2001). Further problems arise when trying to separate the option value from the consumer surplus (which represents the use-value), and Boardman et al. (2014) state that it is not possible to quantify the option value using the information used to estimate the consumer surplus. A reason is that the value of an optional transport mode cannot be traced in travel behaviour.

It is thus not clear how the value of having a transport option is something above and beyond what is already included in accessibility measures. Recently, the concept of substitutability has opened a path forward on this topic. Substitutability

is defined as the extent to which a transport option (mode or destination, or both) can replace another, initially preferred, option (van Wee et al., 2019).

Social exclusion

So far, there has been an ambition to keep a line of sight between the various impacts of transport. When we now turn to the question of social exclusion or transport justice, it is less clear how the pieces connect. Although there are researchers in quantitative fields that pay interest to e.g. distribution (Eliasson, 2016) and different socio-economic groups (Norman et al., 2017), researchers with a more qualitative perspective still consider this to be within an economic dimension (Jones & Lucas, 2012).

The literature on equity and justice in transport addresses of how social exclusion is a function of transport disadvantage and social disadvantage (Lucas, 2012). Stanley and Lucas (2008) stated that social exclusion was a relatively new concept, but has since then expanded vastly (Lucas, 2019). On this topic, transport equity analyses are used to understand the distributions of impacts of transport policy and projects among groups and individuals, for example across older people (Ryan et al., 2019). Preston and Rajé (2007) argued that bottom-up processes, which are more sensitive to local contexts and issues, should supplement top-down planning.. Top-down planning, they argue, involve aggregation that disconnects the analysis from the richness of the individual's experiences. Social impact assessments (SIA) are formal attempts to derive impacts on these issues (Esteves et al., 2012).

Approaches to appraisal and evaluation

We have so far laid out parts of the playing field regarding the links between transport and potential impacts. The task for this section is to give a background to approaches on how to assess and compare specific policies.

The term transport appraisal is hereafter understood as the acquisition and compilation of knowledge before a decision. An appraisal is thus a project or policy evaluation conducted before a decision. Contrastingly, but no less important for knowledge acquisition, is project evaluations made ex-post, introduced in the subsection Ex-post evaluation.

Ex-ante appraisal

An ex-ante appraisal is based on the current knowledge of reality, which is projected into the future. A projection is an extension of our understanding (or model) of reality outside the support of the actual data. An ex-ante appraisal relies for that reason on prognostication on future scenarios. Also, and importantly, appraisal includes a valuation of the prognosticated effects.

Reviews of transport appraisal typically identify CBA as the main approach to appraisal (Bristow & Nellthorp, 2000; Mackie et al., 2014; Næss, 2006)), but there are reviews of alternative approaches such as the MCA (Browne & Ryan, 2011). According to surveys, the CBA is the most widely formalised approach across Europe, the United States and by the World Bank (Andersson, 2018; Bristow & Nellthorp, 2000; Lee, 2000; Odgaard et al., 2006; Talvitie, 2000). OECD (2018) surveyed member countries and concluded that ex-ante CBA is common in the transport sector.

Still, studies have shown that the CBA results have had a weak or no impact on transport investment decisions in the UK, Norway, Sweden and France (Andersson et al., 2018; Damart & Roy, 2009; Eliasson & Lundberg, 2012; Eliasson et al., 2015; Nellthorp & Mackie, 2000; Nilsson, 1991; Odeck, 1996). Further, the CBA plays a near negligible role in regional public transport planning in Sweden (Vigren & Ljungberg, 2018).

In much of contemporary literature, the CBA is presumed to be a tool on the shelf to be applied when needed. The CBA as a method is codified in national guidelines, e.g. in the Netherlands, the UK and Sweden (Beria et al., 2012). In Sweden, the CBA is one part of a total impact assessment (TIA) (Bondemark et al., 2020). This TIA also includes analyses of the distribution of accessibility and the contribution to transport goals. Hence, seen in this codified method-like way, the CBA is analytically narrow and only one part of a broader ex-ante appraisal.

In contrast to the prevailing view of the CBA as a *method*, we also see it as an *approach* to appraisal (Sen, 2000; Williams, 1974). Viewing CBA as an approach means that it is integrated with the whole process stretching from the identification of a problem to the analysis of specific projects and does not limit itself to quantifiable factors. Along these lines, Scott, Scott and Zerbe (2016) found that a CBA, seen as a method, could increase rather than resolve the controversy about a project. Ways to improve the impact of CBA on policy-making could be to move beyond summary statistics like the benefit-cost ratio, communicate reports in the language of laypeople, and avoid to provide false certainty based on the CBA estimates (Scott et al., 2016).

The literature on the method of CBA has taken different directions. One of the directions studies the usefulness and influence of CBA on decisions (Damart & Roy, 2009; Eliasson et al., 2015; Hahn & Tetlock, 2008; Mackie, 2010; Nellthorp & Mackie, 2000; Sen, 2000), another concern model testing and development (Asplund & Eliasson, 2016; Börjesson & Eliasson, 2019; Börjesson et al., 2014; Eliasson & Fosgerau, 2013; Pilegaard & Fosgerau, 2008). Some researchers depart from the idea that the CBA is a democratic tool and crucial to identify the effects and consequences of transport policies and projects (Mackie et al., 2014). Decisions should be based on reason and knowledge instead of persuasive arguments or personal motives (Sen, 2000).

Critique on the CBA

There is no general agreement in the transport research community that the CBA is the proper way to appraise transport measures (Hickman & Dean, 2018; Næss, 2006; van Wee, 2012; van Wee & Roeser, 2013). Recent decades have seen a development of other methods to assess transport measures and support to decision-makers (Beria, Maltese, et al., 2012; Cathy Macharis & Bernardini, 2015). Multi-Criteria Analysis (MCA) is commonly motivated as a method to integrate quantitative and qualitative information (Browne and Ryan (2011). A characteristic feature of the MCA literature is that it departs from criticism on the CBA (Barfod & Salling, 2015; Hüging et al., 2014; Macharis et al., 2009; Macharis et al., 2012), and mostly from the idea that the CBA does not include variables other than economic: “Where non-economic criteria need to be considered, multi-criteria analysis (MCA) is required” (Kumarage & Weerawardana, 2013, p. 212). The MCA consists of several techniques (Tsamboulas et al., 1999), but the unifying feature is that it relies on weights other than money. There are versions on the MCA that aim to take the objectives of stakeholders into account, such as the “multi-actor MCA” (Macharis & Bernardini, 2015).

The last point above is also noted in the critical literature on the CBA in transport. There is allegedly an “apparent gap between planners (visionaries) and economists (calculators) [which] forms a core problem in the CBA process” (Beukers et al., 2012). The lack of communication between plan owners and evaluators could, at least partially, be solved by organising a meeting, according to Beukers, Bertolini and te Brömmelstroet (2015) and te Brömmelstroet et al. (2017). However, some issues that appear to be a problem of the CBA could be general for transport appraisal. A study in the Netherlands found nine problem clusters based interviews with 74 participants in the Dutch CBA practice (Mouter et al., 2013). The researchers found that a significant problem cluster regarded estimation of non-monetised impacts and concluded that other ex-ante appraisal methods (such as the MCA) would face the same problems.

Ex-post evaluation

Various empirical methods are employed to assess the impacts of projects. Rietveld (1994) separate “models” and “other approaches” on the one hand, and between models/approaches using aggregate and disaggregate data on the other hand. The models include stated and revealed preference (both disaggregate) and land use and transport interaction models and general equilibrium models (both aggregate), whereas the approaches include, for instance, quasi-experimental methods.

Quasi-experimental methods are conducted ex-post and aim to take the counterfactual development into account (Athey & Imbens, 2017; Imbens & Wooldridge, 2009). Difference-in-differences (DD) is one of these methods (Wing et al., 2018), and previous research has applied it to impacts of transport on housing

and floor space prices (Ahlfeldt et al., 2015; Diao et al., 2017; Hoogendoorn et al., 2019; Percoco, 2014). The impact that the early railways had on population in connected towns in Sweden (Berger & Enflo, 2017), and individual labour market outcomes in Sweden (Åslund et al., 2017). In Norway, DD studies have analysed the impact of fixed links and airports on population growth (Andersen et al., 2018; Tveter et al., 2017), and firm size and number of firms (Nilsen et al., 2017). However, DD is not unblemished as Bertrand et al. (2004) found that the DD approach suffers from the risk of over-rejection of the null hypothesis, because of the understated standard deviation of the treatment effect.

Concluding remarks

Transport services are not operated in a vacuum. Economists tend to use the wording “transport as a derived demand”. That is, the demand for transport services exist because there is a demand for spatially dispersed amenities, goods and services (although there are researchers who argue that transport could have an intrinsic value (Geurs et al., 2009)). Each person faces trade-offs where transport is just one out of several factors (Weisbrod et al., 1980). Bohm et al. (1974) state that, in principle, there is nothing remarkable about transport in the sense that persons make trade-offs and choices as with any other good or service. On the aggregate level, there are arguments that land-use planning has a greater impact on transport than the opposite (Börjesson et al., 2014).

There are two chief takeaways from this section. Firstly, one strand of literature is concerned with the value of transport, such as possible option values, to individuals and ways to better account for these in an appraisal. Although, before including them in a standard CBA one needs to consider their relation to user values already accounted for (Holmgren & Merkel, 2017). Secondly, ensure that the potential impacts are the result of the policy (Laird & Venables, 2017). Counterfactual thinking is critical in both ex-ante appraisal and ex-post evaluation. There is an ex-ante knowledge gap as to the extent that public transport has an impact on individual behaviour beyond the user benefits, compared to alternative policies. There is an ex-post challenge to solve the so-called reverse-engineering problem, or to separate the milk from a cup of tea, to put it metaphorically.

Transport planning in Sweden

In Sweden, transport planning is a public business on different governmental levels: national, regional, and local. On the national level, the parliament, via the government, gives instructions to the Transport Administration (Trafikverket) about the priorities of transport infrastructure and services of national interest, mostly

national roads and railways but also procurement of long-distance train and airline services. The regional governments in Sweden are responsible for the regional public transport supply and coordination of other policy areas that are geographically regional, e.g. concerns for labour markets. The local governments are responsible for local infrastructure, e.g. streets and bus stops, and other urban planning.

On the national level, there are also several agencies with overlapping tasks, such as future scenario analysis. For example, the Energy Agency (Energimyndigheten) and the Transport Administration have two conflicting scenarios on future transport use. The Swedish National Audit Office concluded that this conflict was problematic (Riksrevisionen, 2019). The Swedish planning literature commonly uses the term “*samhällsplanering*”, which lacks a good English translation. However, it can be said to be the combination of land-use planning (including infrastructure) and social policies. It constitutes the planning and coordination of visible land-use and less tangible demographic aspects.

The fragmentation of planning in different departments and administrations has motivated studies of collaboration (Hrelja et al., 2016; Pettersson & Hrelja, 2020). The need for collaboration practices increases with the number of stakeholders having separate responsibilities and budgets.

Regional public transport, the focus of the thesis, is planned and financed by regional public transport authorities (PTA). The Public Transport Act from 2012 (SFS, 2010:1065) stipulates that each region should have a PTA and that the authority should develop a transport provision programme. These regularly updated programmes include the need for all regional public transport, both fully commercial and subsidised transport, as well as the goals for transport provision. The PTAs commonly procure traffic operations to private companies.

Thesis structure

The rest of the thesis is outlined as follows. Chapter 2 introduces the aims and research questions. Chapter 3 presents the theoretical framework; introducing the thesis' approach to decision-making, transport planning, and its economic impacts. Chapter 4 contains a description of data sources and method. Chapter 5 presents the findings in the papers. Chapter 6 synthesises the results of the papers in terms of the thesis research questions. Lastly, chapter 7 concludes the thesis.

2 Aim

The overall aim of the thesis is to investigate the knowledge problem in regional public transport planning in order to increase the general understanding of appraisal and evaluation of public transport and contribute with empirical observations on public transport planning and effects of transport accessibility in Sweden. The research questions (RQ) are as follows:

RQ 1: What is the task of regional public transport, and how is it thought to contribute to societal goals?

RQ 2: How are the strategic goals guiding the use of appraisal?

RQ 3: How can accessibility be defined and analysed in a regional public transport setting?

RQ 4: What is the relationship between accessibility and economic indicators?

The papers included in the thesis aim to provide answers to the research questions, as displayed in Table 1. Paper 1 and paper 2 are qualitative inquiries into regional public transport planning and appraisal. More specifically, paper 1 is an explorative investigation, and paper 2 is a study of a specific project concerning research questions 1 and 2. Research question 3 is addressed in papers 3, 4 and 5. These three papers empirically test the outcomes of three different ways of measuring accessibility. Paper 4 and 5 also contribute to the answer to research question 4, since both analyse annual labour income.

Table 1

The connection between papers and research questions (RQ).

	RQ1	RQ2	RQ3	RQ4
Paper 1	x	x		
Paper 2	x	x		
Paper 3			x	
Paper 4			x	x
Paper 5			x	x

Papers 1 and 2 have a close connection, attributed to the methods and topic of study. The other three followed from the conclusions of mainly paper 1. Paper 3 is

addressing transport more broadly than papers 4 and 5, but it exploits a topic of relevance for public transport policy.

The papers and the progression of the thesis

The individual papers in the thesis focus on specific topics, as introduced above. The thesis consists of different parts, where each part builds on or leads to one another, and ends up as a collection of knowledge that is more than the sum of its parts.

Paper 1, also the first one written and published, serves as a foundation to the thesis and is a prerequisite for papers 2, 4 and 5. Paper 3 is more stand-alone in this sense because it does not strictly build on, or lead to, any other paper. The explorative inquiry of paper 1 leads to insights and conclusions that feed into the case study in paper 2 and the topic of the quantitative analyses in papers 4 and 5.

Meanwhile, a social scientist never stands outside of the topic under observation. A social scientist can be said to produce, or enact, “the social” (Law & Urry, 2004), meaning that he or she not only describes the world from the outside but exists in, and impacts the world. This is perhaps to give undue importance to oneself, and more important in the thesis is the notion that researchers have a degree of uncertainty and doubt in the research process (Alvesson et al., 2017, p. 89): “To develop his or her understanding, a scholar’s reading needs to be diverse and progress over time.”

While the papers concentrate on digesting and contributing to specific contemporary literature, the thesis as a whole has been a process that has distilled and formed my readings and thinking gradually. I turned to slightly older literature to put my papers into perspective, and a side effect of bringing up Buchanan, Shackle and others is that the research community gets reminded about their ideas. Readings of older significant contributions are essential for the research community so as not to forget them (Alvesson et al., 2017).

Unlike mathematics, where it is plausible to assume that new books are at least as up to date as older books, the social sciences do not progress without loss of relevant ideas. The ideas of dead economists are not irrelevant because they are not incorporated in the mainstream discipline, but rather, as Boulding (1971) argued, books of the past are our “extended present”. An idea or book that is relevant and commented on belongs to the extended present, regardless if the author is dead or alive (Boulding, 1971).

3 Framework

This chapter presents the conceptual ideas that the thesis builds on. The purpose is to give an overview of what I consider is needed to put the individual papers in its context, and to answer the thesis' RQs. The sections of this chapter cover different parts of what I call the knowledge problem in public transport planning. The first section focuses on the first two RQs, which rest on the concepts of decision-making, society, economy, and appraisal. What ideas can we use to grasp collective choices and ex-ante knowledge collection? The central point is that information is costly, full factual knowledge is never complete before a decision, and choices depend on subjective value judgements as well as predicted relationships.

The second section focus on the consequences, or impacts, of transport. That is, what can we say about the causal evidence concerning the association between transport measures and accessibility, and the relation between a transport policy and the regional economy? The emphasis is not on providing actual estimates but on consideration of the knowledge problem. If the two RQs above concern the problem of ex-ante knowledge collection and use, the two latter RQs concern what ex-post knowledge that we can establish.

Economics and decision-making

In Sweden, over the last decade, subsidies cover on average 50 per cent of the costs in public transport (Trafikanalys, 2018). Public funding is typical in London, UK, where 33 per cent of the income comes from the government, and in the US (Litman, 2017; Transport for London, 2020). Economic literature commonly acknowledges transport policy as a problem of collective decision-making based on its features as a natural monopoly with scale economies, external effects, as a means to discourage car use and to coordinate interdependent transport services (Bohm et al., 1974; Parry & Small, 2009). Thus, the thesis presumes that public transport, to some extent, is funded and decided collectively. The question then becomes how tax money gets spent where they are of best use.

This section elaborates on welfare economics as a benchmark approach for social choice and how it affects transport planning and decision-making. We can say that

this section has the meta-ambition to discuss how we can think about how we think. This is done in order to grasp the ex-ante knowledge problem.

Economics and the CBA

The CBA is a well-known approach to appraisals of transport policies. With its roots in welfare economics, it provides the analyst with tools to compare the upside of the provision of public goods to its downside and compare across alternative courses of action. The point of departure of welfare economics, as all economic analysis, is methodological individualism, i.e. the individual is the focal point of analysis.

Key landmarks for the application of welfare economics in transport was the theory of time valuation by Becker (1965) and McFadden's (1973) choice modelling. Time is essential in welfare economics because it can be seen as a production factor of transport, provided by the passengers, along with fuel and other production factors. That is, the passengers of a particular bus service give up some of their time to take the bus. Without their time being spent, there would be no actual bus trip but merely a moving metal box that we call "a bus". The time value of a bus trip, defined as the value the passengers put on the next-best alternative use of their time, is, therefore, an essential concept in welfare economic transport appraisal. The development of discrete choice theory was important to model how individuals make travel choices given a set of travel options and the options' attributes (Ben-Akiva & Lerman, 1985).

Simplification as a method of analysis

All models are based on simplifying assumptions to make reality simpler to grasp, such as the assumptions about individuals' well-defined and stable preferences (Kornhauser, 2000). These assumptions are, of course, not a description of reality. Instead, they can be considered as a method of analysis (Becker, 1993). The reason for assuming insightful individuals with stable preferences is for the sake of analysing a scenario *as if* individuals behave in highly predictable manors (Friedman, 1953).

When we, for example, want to analyse a new railway line, the core differences of people's actions with and without the line is of interest. A model that is making simplifications can allow the analyst to focus on these core differences in a situation with the railway compared to a situation without, and thereby improve our understanding on that specific matter. Another way to put it is that the analyst uses a theoretical microscope to analyse how behaviour might be changed when we alter one parameter in the environment while assuming that the rest of the complex world is unchanged.

Positive and normative economics

As we have mentioned, in addition to this “positive” analysis, economics also has the ambition to compare policies and make normative policy recommendations. In other words, the accuracy of the map, the model, is one problem since some maps are certainly better than others, while the other problem is which path to choose. Hicks (1939), one of the founders of the “new welfare economics” described parts of the evolution of economics as follows.

“During the nineteenth century, it was generally considered to be the business of an economist, not only to explain the economic world as it is and as it has been, not only to make prognostications (so far as he was able), but also to lay down principles of economic policy, to say what policies are likely to be conducive to social welfare, and what policies are likely to lead to waste and impoverishment.”

Hicks (1939) and Kaldor (1939) developed Pareto’s (1906) decision criteria into one of potential compensation. They stated it as: if the gainers of a policy could make a hypothetical money transfer to the losers, the policy would lead to social welfare improvement. It is this problem, the normative part, that this section is interested in. We noted at the beginning of the thesis that the CBA can be viewed as an approach to appraisal or as a codified method, sometimes formalised as a computer program. Most discussion about the CBA is connected to this applied method.

Criticism of the CBA

The utilitarian calculus, as welfare economics is occasionally called (Hicks, 1939; Sen, 2009), has met some criticism, both in general terms against its foundations and more specifically against its application in transport analysis. Prominent economists have launched severe criticism on the CBA, and on welfare economics in general. Buchanan (1999, p. 53) outlined his critique on CBA as follows:

“The cost-benefit expert cannot have it both ways. He cannot claim ‘scientific’ precision for his estimates unless he restricts himself rigidly to objectively observable magnitudes. But if he does this, he cannot claim that his estimates reflect reasonable norms upon which ‘social’ choices should be based.”

Buchanan argued that economists “can never say that one social situation is more ‘efficient’ than any other” (1959, pp. 137–138). Instead, they can propose a hypothesis that a situation is more efficient than another situation, and whether that is true is tested in a political vote. Thus, the political economists’ scientific role is to find out what people might want, not to impose a solution upon them. If researchers do not recognise the distinction between predicted relationships and subjective values, the study of economics is no more than applied mathematics

(Buchanan, 1964). Sen, a Nobel laureate like Buchanan, stated in the book “The Idea of Justice” (2009, p. 278), that

“welfarism without interpersonal comparisons is, in fact, a very restrictive informational basis for social judgements. We could discuss whether the same person is happier in one state than in another, but could not compare, we were told, the happiness of one person with that of another.”

Elsewhere, Sen (2000) criticised the use of the market analogy for valuing intangibles. He especially scrutinises the “lone ranger” model for evaluation that each individual is assumed to live in an asocial bubble. In the same issue of *Journal of Legal Studies*, Nussbaum (2000) criticised the CBA on moral grounds and Richardson (2000) criticised its inflexibility to reformulate ends in light of new information and preferences. The answer to the moral critique is that the technique of CBA is not undermined by the refutation of the cost-benefit moral theory (Hubin, 1994). If the CBA is seen as an approach to appraisal it comprise considerable flexibility. Still, this limits the applicability of the mainstream method of CBA.

Some criticism on the application of CBA in transport planning as outlined in the introductory chapter noted its inability to include aspects that do not easily lend themselves to quantification, such as social exclusion. Also, the inability to consider justice and fairness has been a source of criticism (van Wee & Roeser, 2013). This inability is related to Sen’s point above. If welfare economics is unable to compare happiness between people, it becomes impossible to talk about fairness.

Now, what we want to do is to set a framework for what knowledge that appraisal methods like the CBA can bring to the decision-making room and who the recipient is of appraisal results.

Decision-making

Synoptic decision-making

Decision-making can be defined as a process consisting of three parts (Simon, 1976). The first part is intelligence, i.e. collect information to understand the situation and potential problems. The second is to consider and analyse alternative courses of action and assess those alternatives in terms of how they improve the situation. The third part is choosing a course of action. Textbooks in economics commonly depart from this conceptual decision-making framework, with different start and endpoints and focus along the way (see e.g. Button (1993), Miser (1995), Hultkrantz and Nilsson (2004), Boardman et al. (2014) and OECD (2018)). I am following the terminology used by Braybrooke and Lindblom (1963) and label this a “synoptic” strategy.

Adjacent to this, Simon defines a dichotomy between “factual judgements” and “value judgements”. Value judgments are such judgements that lead to the selection of goals, and factual judgements such judgements that involve the implementation of the goals. While the former type of judgment is not a question of true or false, the latter types are. Consequently, prophecies about the future contain elements of both value and facts, a point made by de Bruijn and Leijten (2008) in a transport context.

Let us illustrate by an example borrowed from Simon (1976, p. 250). A statement that “Project A is good” can be translated into one ethical and one factual part:

Project A will maximise social welfare.

To maximise social welfare is good.

Simon argues that the first sentence, the factual statement, is relevant for science, whereas the second one is an ethical imperative and is not of direct social scientific interest. From this perspective, social science is supposed to be value-free and only interested in objective truth. The dichotomy between facts and values has been challenged (Putnam, 2002), but I find it a useful distinction to understand the positive and normative sides of economics outlined above.

Decision-making in reality

In reality, there are three problems with the ideal “synoptic” decision-making process. The first one is that the problem-solving process might be turned upside down by identification of a policy proposal instead of an unachieved goal (Braybrooke & Lindblom, 1963); thus the means get the attention rather than the ends. A solution becomes the focal point, and the planning process gets involved in searching for and attaching, desirable ends to the solution. Planning of mega-projects tends to be characterised by this process (Priemus, 2008).

There are two plausible reasons why the characteristics of mega-project planning is problematic. Firstly, it is hard to find out about alternative actions (Mackie et al., 2014) because the real problem is ill-defined. Secondly, financing of mega-projects is typically national, but benefits are regional, which makes it a case for lobbying (Buchanan & Tullock, 1962). Given this, there is a risk that ignorance about project costs are ignored Flyvbjerg (2016), with the potential consequences that costs are underestimated and benefits overestimated (Flyvbjerg, 2009; Flyvbjerg et al., 2018).

The second problem with the synoptic process is how to weigh ends against each other. We have already elaborated on the welfare economic approach. In short, there are some difficulties with the welfare function; a multiplicity of values, instability of values and conflicts among (combinations of) values. These difficulties make it difficult to rationally deduce best policy choice (Braybrooke & Lindblom, 1963, p. 54):

“A number of diverse individuals and groups are each thwarted in different ways in the pursuit of diverse and sometimes conflicting goals. ‘The problem’ is in fact a cluster of interlocked problems with interdependent solutions.”

Another conception to rank policies is the “naïve priorities method”, a ranking of ends (Braybrooke & Lindblom, 1963). However, a priority such as “traffic safety ahead of accessibility” does not tell whether better safety no matter how little is better than improved accessibility no matter how much.

The third problem in synoptic decision-making processes is the time that is required to find and analyse alternatives, and resources that have to be employed in order to acquire information. Because time is not a free good, there will always be a trade-off between costs (in terms of time and other resources) versus more information (Braybrooke & Lindblom, 1963). Shackle (1972, p. 22) went a bit further and described the problem of figuring out all alternative courses of action as “a Pandora’s box of possibilities beyond reach of formulation.”

The chief problems with an ideal synoptic model, where a formalised CBA works best, is understood by transport economists in three ways (Mackie et al., 2014). First, it is unclear how the CBA should be integrated into a planning process, e.g. when will a CBA result be of best use for decision-makers? Second, transport policies have moved from focusing only on travel time towards harder-to-quantify aspects. Also, since transport economists and engineers think in comparative statics, while planners think in dynamics, it will be even harder to integrate the CBA in planning. Third, a systematic CBA is not sensitive for particular contexts, e.g. a project might be connected to a broader regional strategy.

Choice and cost in decision-making

A potential source of the disconnect between what “ought” to be decided, according to a CBA, and what actually “is” decided is different conceptions of costs. Costs are normally defined in opportunity terms; that is, the costs of action X are the foregone benefits of action Y. However, we must ask for whom cost is relevant (Buchanan, 1999). For the analyst who can summarise costs objectively, or for the decision-maker who see costs subjectively? For the latter, costs are tightly coupled with the act of choice. Meanwhile, for the former, costs are merely numbers.

Choices are made by individuals, whether it is for themselves or in the name of groups, organisations or administrations, and the act of choice is *to select one course of action over another*. Consequently, a selection of one course of action that does not exclude any other action is not a choice, because it does not leave any forgone alternatives. Shackle (1972) argued in his book “Epistemics and Economics” that choice is *originative* in the sense that choices shape reality and “is the start of a new train of influences” (1972, p. 122). Further, both Shackle (1972) and Buchanan (1999) maintained that costs for a decision-maker have a clear distinction between ex-ante and ex-post, but the analyst can take an ex-post view (Shackle, 1972, p. 289).

“...while the analyst can take an *ex post* view of what to the (imaginary or hypothetical) participant still lies ahead [...] the participant at each location of his ‘present moment’ is concerned to make or modify a policy of a plan.”

It is crucial for researchers and analysts who look at decision-making from a distance to keep in mind that decision-making is a task done by individuals with subjective values. The decision structure determines how decisions get made (Buchanan, 1999).

The Nobel laureate Ostrom (2005) discussed markets, firms, and national governments as action arenas. Each arena constitutes of participants and situations, where the situation is the social space of, for instance, interactive problem-solving or exchange. The working rules that structure these interactions are not always obvious but important to understand. Some rules, Ostrom argued, do not exist in written documents, only as rules-in-use.

To sum up, by dropping the assumption that decision-makers represent the public interest, we face the task to understand their interests and incentives. Also, to assess the rules and the structure within decisions are made, following Ostrom and Buchanan.

Disjointed incrementalism

Braybrooke and Lindblom (1963) discuss what they perceive to be a more realistic strategy, called “disjointed incrementalism”. In this framework, the decision-maker is selecting ends based on the means available, which restricts the number of consequences considered and adjusting objectives at the same time as the means.

In reality, they add, there is a fragmentation of analyses and evaluation undertaken by various governmental agencies, each with imperfect communication. The term disjointed is used with reference to the point that there is a fragmented goal structure across authorities, i.e. there is a lack of unitary goal. The fragmentation was exemplified by Simon (1978) in his Nobel Memorial Lecture. It is also fragmented in the sense that a government agency could develop an unclear structure of ends. It gets hard to disentangle means-ends and therefore, also facts-values.

Lindblom (1959) argued that the term incrementalism comes from the many small changes that characterise for example, public transport policy. In cases where many small decisions are taken, a model that is “greedy for facts” might demand unrealistic resources for analysis. Also large-scale evaluations are costly to make (Boardman et al., 2014).

Spatial implications of transport

While the previous section established a frame for research questions 1 and 2, this section does the same for research questions 3 and 4: accessibility and its links to economic activity. This section takes a backwards-looking viewpoint of the ex-post knowledge that we can establish of transport measures. First out is accessibility, which is the main product of transport measures, then we take a look at the economic theories on the links between accessibility and regional economic phenomenon.

Accessibility

Accessibility can be looked upon and defined from numerous perspectives. First of all, one can look at it from the micro-level or macro level. The micro level places focus on the small scale, such as kerbstones and steps in the environment, and the macro-level places focus on people's access or accessibility to destinations and the catchment area for locations. At the same time, the macro-level accessibility is strictly dependent on the micro-level accessibility. When the micro-level is in order, people can start to benefit from the macro-level accessibility that is provided by a public transport network.

Second, macro-level accessibility can be place-based or person-based. Place-based (or location-based) accessibility concerns the catchment area of a location. It can, for instance, be measured as the number of people that can access a location (e.g. hospital) within a specific time limit, or the number of jobs that are within, say, a kilometre from a train station (Geurs & van Wee, 2004). People-based (or person-based) accessibility, on the other hand, is regarded as individuals' access to particular destinations, or how many pharmacies that are accessible with a given time budget, for instance.

Accessibility definitions

There are many definitions of accessibility, which can lead the researcher to use different indicators (van Wee, 2016). Hansen (1959) defined it as “the potential of opportunities for interaction”, and Dalvi and Martin (1976) defined it as “the inherent characteristic of a place with respect to overcoming some form of spatially operating source of friction”. While the Dalvi and Martin definition has a place-based focus, Geurs and van Wee (2013, p. 208) use the following more people-based definition:

The extent to which land-use and transport systems enable (groups of) individuals to reach activities or destinations by means of a (combination of) transport mode(s) at various times of the day

Some definitions of accessibility echo the classic location theoretical view of transport costs as “all the forms of spatial friction that give greater attractiveness to a location which reduces the distance between two points in space” (Capello, 2014, p. 508). A typical starting point in transport modelling is therefore often that the demand for transport is derived from the demand for amenities and activities at spatially dispersed places. Therefore, transport is thought of as a burden, in terms of time and other resources, to the individual person or firm. This burden decreases with lower “friction” between two places. Besides the land-use and transport system components, researchers discuss an individual and a temporal component (Geurs & van Wee, 2013).

The individual accessibility component captures individual attributes, needs, and social status; individuals might be incapable of travelling for various reasons even though there is an excellent transport network. It can also be that the employers within reachable distance demand skills other than the ones that specific individuals possess. The temporal component reflects the availability of activities at specific times of the day. Individuals working evenings and nights are excluded from other activities at those times even though that individual has the capability and spatial proximity.

Accessibility indicators

Handy and Niemeier (1997) explore accessibility measurements and distinguish cumulative opportunities measures, gravity-based measures and utility-based measures. They state that most accessibility measures have a transport element (exemplified as resistance or impedance) and an activity element (i.e. attraction). Implicitly in these two elements, there is also a temporal component because the transport system and activities vary in availability during the day and night (buses run more frequent in peak hours and shops are closed at night).

Gravity-based measures can be expressed as a relationship between accessibility, A , at location i and activity, a , in location j , times a decay function $f(\cdot)$ where d represents the distance or travel time between i and j .

$$A_i = \sum_j a_j \times f(d_{ij})$$

The decay function represents how much an activity contributes to accessibility given the transport cost. Cumulative opportunities measures can be understood as a special case of gravity-based measures where $f(\cdot) = 1$ for activities with a transport cost within a certain threshold and $f(\cdot) = 0$ for activities beyond that threshold. Geurs and van Wee (2004, 2013) categorise these accessibility measures as location-based. The attractiveness with these measures is that they are relatively easy to

communicate to non-experts and cumulative measures do not require advanced expertise to compute.

Utility-based measures depart from discrete choice theory and utility maximisation. Given a set of alternatives, an individual is assumed to make the choice that maximises expected utility (Ben-Akiva & Lerman, 1985). The appeal of utility-based measures is that they are based on travel habits, take into account multiple trip alternatives, and the generalised travel costs. It is thus theoretically sound, but the drawbacks are that it is more difficult to compute due to data requirements and advanced modelling, and harder to communicate to non-experts.

Spatial economics

We have so far described the components of accessibility and some approaches to measure it, but accessibility is most commonly not the ultimate goal of transport policy. I define accessibility as an output measure in contrast to outcome measures (Jackson, 2011), for instance, the link from transport to labour market outcomes.

Space was quite recently “rediscovered” in economic literature (Fujita et al., 1999), and it has since around 1990 attracted much attention and together with contiguous disciplines formed a massive body of research. This is evident in the sheer size¹ of the Handbook of Regional Science (Fischer & Nijkamp, 2014). This section will elaborate on some broad theories of spatial economics without the ambition to be all-encompassing, and I refer to the introductory chapter in the thesis for some recent empirical studies on the topic.

The economic subfield of spatial economics is itself a parent topic to the fields of transport economics, urban economics and regional economics (Proost & Thisse, 2019). The thesis is positioned in the transport economic literature and is principally interested in the connection between regional transport and the regional economy.

It has long been known that the size of the market limits the degree to which individuals can specialise into different skills (Smith, 1976), and spatial economic theory has for centuries tried to explain the unevenness of space and posed questions such as: Why do certain settlements develop into large cities? To what extent do exogenous or endogenous factors determine regional development? Exogenous factors are those that come from outside, such as a new transport link, whereas endogenous factors are those that develop from within a place. Some theories depart from the idea and observation that decisions among firms and workers cause positive spill-overs, or externalities, to other parties. The literature usually categorises such positive externalities that are industry specific as localisation externalities, and externalities that are city specific as urbanisation externalities. The localisation externalities concern effects that are internal for the firm but external

¹ Almost 1700 pages.

for the industry, and the urbanisation externality concern effects that are internal for the firm and industry but external across industries (Beaudry & Schiffauerova, 2009).

Another way to understand how urban regions benefit from better accessibility between firms and jobs are through the three mechanisms, matching, sharing, and learning (Duranton & Puga, 2004). The matching mechanism concerns the functioning of the labour market: how well workers find jobs that match their skills and how easy firms find workers that meet their requirements. Sharing is about the indivisibility of goods and services. Cities enable firms and individuals to share public goods, e.g. transport infrastructure, and marketplaces. Within an industry, this can be thought of as several companies sharing an input factor. Lastly, the learning mechanism concerns the diffusion of knowledge, and the point that “ideas cross corridors and streets more easily than continents and seas” (Glaeser, 2011, p. 36). That is, knowledge is still transmitted more quickly in the local and regional area than across the globe, despite the vastly reduced communication costs over the last few decades.

Orders without design

I end this section with an epistemological note on the complex reality that transport planners try to navigate in. The learning mechanism that we encountered above was pioneered by Jacobs (1969). It took some time for her ideas of endogenous effects of human capital to be incorporated into the economic literature (R. E. Lucas, 1988). In tandem with her economic ideas, her writing carried a message to policy and planning. She wrote (Jacobs, 1969, p. 250):

“The bureaucratized, simplified cities, so dear to present-day city planners and urban designers, and familiar also to readers of science fiction and utopian proposals, run counter to the process of city growth and economic development. Conformity and monotony, even when they are embellished with a froth of novelty, are not attributes of developing and economically vigorous cities.”

This conception was echoed in the contemporary writings of Hayek (1978, p. 73) who claimed that “not all order that results from the interplay of human actions is the result of design”.² The book “Order Without Design” by Bertaud (2018), an urban planner with decades of practical experience, recently repeated this idea yet again. Hence, not only economists emphasise the bottom-up process of markets, other thinkers, such as Jacobs and Bertaud, arrive at these conclusions independently. This is the chief takeaway from this section: top-down planning as an enabler of bottom-up processes of matching, learning, and sharing. Processes that

² The remark by Hayek originates from Ferguson (1782).

reinforce regional and urban development but are too complex to steer with scientific precision.

Conclusion of the framework

The thesis separates the knowledge problem of transport policy in two parts, ex-ante and ex-post. Figure 1 relates the framework to the research questions. Suppose we allow ourselves to see transport policy as an ideal linear process. In that case, the first two research questions are addressing the goal setting and planning stage. This is the ex-ante part of the knowledge problem. The last two research questions address the impacts of transport in particular contexts and the ex-post knowledge problem.

The ex-post knowledge of an implemented project is naturally part of the solution to the ex-ante knowledge problem of future decisions. Therefore, there is a loop running from ex-post impacts assessments to the formulation of policy goals in Figure 1.

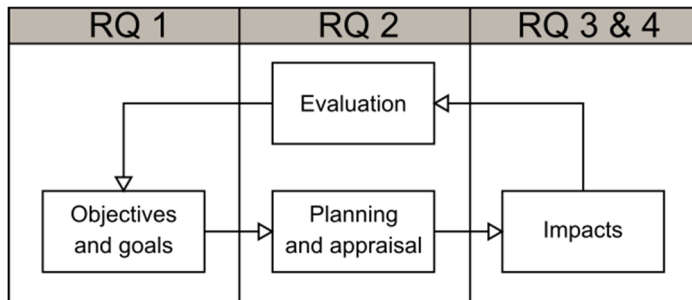


Figure 1. A sketch of the ideal decision-making process and how the RQ fit into this.

For simplicity, we sketch regional public transport planning linearly, bearing in mind that it is much more complex in reality. It begins with setting the goals of the regional transport system; it could be the market share of public transport as a proportion to all motorised transport. RQ 1 aims to investigate this part. Then, to reach the goals, planning activities are needed to arrive at possible means to achieve the goals. Alternative means are appraised and assessed ex-ante. RQ 2 aims to analyse this, as well as the evaluation work that is done after the implementation of a policy. In other words, RQ 2 focus on the planners' practices with appraisal and evaluation. Contrastingly, RQs 3 and 4 are based on empirical work from which I try to provide knowledge on the ex-post knowledge problem.

A restatement of the research questions:

RQ 1: What is the task of regional public transport, and how is it thought to contribute to societal goals?

RQ 2: How are the strategic goals guiding the use of appraisal?

RQ 3: How can accessibility be defined and analysed in a regional public transport setting?

RQ 4: What is the relationship between accessibility and economic indicators?

4 Methods and data materials

The thesis uses both qualitative and quantitative methods to examine the topic. This chapter introduces the methods together with some methodological considerations. Table 2 show which type of empirical method each paper is based on.

Table 2
The papers categorised in terms of method type.

Method	Paper 1	Paper 2	Paper 3	Paper 4	Paper 5
Quantitative			x	x	x
Qualitative	x	x			

Qualitative methods

Paper 1 and 2 builds on qualitative inquiries, see table 2. The primary purposes of these papers are to understand ex-ante planning processes and appraisals, while paper 1 also has some focus on ex-post evaluation. In order to study transport policy ex-ante, one can use modelling approaches that, calibrated on data, can create scenarios of the future. Forecasting models can give insights into likely future developments of factors that are of importance for transport behaviour (Andersson et al., 2017), and models can be used to formulate welfare rules for decision-making (Börjesson & Eliasson, 2019).

Ex-ante planning can also be investigated through surveys such as that Vigren and Ljungberg (2018) made where representatives of organisations answered questions about their use of CBA. A step even further into qualitative methodology is to conduct in-depth interviews with representatives of organisations and studying public documents, as done in papers 1 and 2. Qualitative interviews have the strength of investigating questions of “why”, while surveys investigate questions of “what” or “how many”. For instance, planning as an activity is not pre-programmed in the sense that a decision rule can be established for any given decision. Instead, the qualitative studies view planning as a process of multiple and changing trade-offs, and in order to understand these it is useful to get to understand the people working with these topics. In mathematical models, the employees at transport administrations are obtaining and using information without costs or other obstacles, but in reality, the employees are fallible like any other person.

Decisions are made in a social context (Kay & King, 2020); we need to cooperate with other people and depend occasionally on other people for the implementation of decisions. And we should remind ourselves, yet again, that people have subjective values. Public choice scholars have emphasised the need to investigate the practices of individuals as civil servants in public administrations just as we study individuals as market actors (Buchanan, 2000).

Epistemological position

Interviewing is a method to gain an in-depth understanding of the experience of individuals in particular contexts. We can say that there are two metaphors of an interviewer (Brinkmann & Kvale, 2015): the interviewer as a miner and as a traveller. While the miner is unearthing the truth about the subject, the traveller explores distant lands and gain new experiences. The thesis originates from the miner metaphor of interviews, that is, the interviews come from a positivistic research tradition. In other words, the thesis assumes a dualist ontology and an objective reality that can be communicated by the use of language (Sandberg, 2005).

A more accurate description of the epistemological foundation of the interviews is neo-positivistic, as discussed by Alvesson (2011). The neo-positivist position is characterised by an interview as a transmitter of knowledge, where the interviewer is neutral, and do not deviate from the interview structure. The research process in a neo-positivist position is thus objective, neutral and transparent.

Still, the miner and traveller interviewing positions are not distinct. Thus we cannot rule out that parts of the knowledge in the interviews can be understood from a phenomenological viewpoint, the interviewer as a traveller. The interview approach was explorative rather than hypothesis testing. Phenomenology understands the world as the subjects experience it, and in this way, research can be seen as a way of learning (Flyvbjerg, 2006). This phenomenological view of knowledge has also come to influence the synthesising in this cover essay, i.e. that social science as a study of human action and interaction calls for a variety of interpretations (Alvesson et al., 2017).

Interviewing as craftsmanship

Brinkman and Kvale (2015) advance the idea that interviewing is craftsmanship. Skills are earned by experience. In contrast to quantitative approaches, which consist of rules to follow to realise a precise research aim, qualitative knowledge is produced socially between interviewer and interviewee and depends on the skills and judgment of the interviewer. Thus, this research tradition does not assume that knowledge is waiting to be uncovered by anyone who has the right tools, but as a process of skills and interpretation by the researcher. In qualitative research,

therefore, the researcher must be reflexive about his or her role in the creation of knowledge (Alvesson & Sköldbberg, 2009).

Practical interview issues

Problems in so-called elite interviews (understood as interviews with people in their professional role) can arise from multiple sources (Richards, 1996). The memory of the interviewee can be lacking, and there are risks of getting contradictory answers along the course of a single interview. The interviews for both paper 1 and 2 concerned such general topics in which the interviewee did not need to have specific knowledge but rather to elaborate and reflect on the work of the organisation and their own part of that work. There is a potential difference between the interviewees “knowing” and their “telling” (Alvesson, 2011, p. 30), which can go in two different directions. One risk is that interviewees have difficulties in articulating tacit knowledge, and another risk is that the interviewees use smarter words and are capable of telling more than they know (Alvesson & Sveningsson, 2003).

Another potential problem is that the interviewee might take control of the interview in order to steer the conversation in a preferred direction. For the interviews in papers 1 and 2, we used interview guides that structured the topics of the interview, which improved stringency.³ Although Berry (2002) argued that the best interviewer is the one who use open-ended questions to make the interview situation as a conversation among old friends, the interviews in papers 1 and 2 are based on a semi-structured format. The structure of an interview is, as explained by Alvesson (2011), a matter of degree between highly structured and loosely structured. Semi-structured interviewing is understood as a discussion of given topics and some given but open-ended questions that allow the interviewee to expand in his or her way.

The interviews in papers 1 and 2

Beyond the interview situation itself, it is vital to get access to the right persons and interview enough number of persons. In the interviews in papers 1 and 2, we made contact either directly with the person responsible person for the specific role I was looking for, or via contacts that we had at these organisations. The other issue concerns what is usually called saturation of knowledge, that is, the point when more interviews do not add new knowledge.

In paper 1, the selection of public transport authorities (PTA) was based on geographical location. The study aimed to analyse both populous regions (in a Swedish context) and adjacent smaller regions. Among the three more populous regions, we selected Regions Skåne and Stockholm and added three smaller regions,

³ The interview guides are included in the appendix.

Halland, Blekinge and Södermanland, bordering one of the larger two. Thus, potential persons to interview had to be working in one of these regional PTAs interviewees were located. We interviewed nine persons in total, six men and three women. Four of the interviews were conducted face-to-face and five via telephone. Because there are few persons with the relevant role and experience in these organisations, adding more people would have included people with other roles. Further, in Stockholm, it was difficult to access more persons than the two I managed to interview.

In paper 2, we examined the project Spårväg syd in Region Stockholm. We interviewed persons who had worked with the project; two persons at the consultancy firm that made the calculations and two persons at the PTA that synthesised the assessments. Again, few people are involved in certain projects, so the interviews were complemented by documents.

Documents

We selected the three most recent regional development plans (published 2001 (RUFSS 2001, 2001), 2010 (RUFSS 2010, 2010), and 2018 (RUFSS 2050, 2018) respectively) to provide the historical context to the project Spårväg syd. As argued in the Framework chapter above, public decision-making tends to originate from an objective that forms subsequent policymaking. We also read a pilot study published in 2012 (AB Storstockholms Lokaltrafik, 2012), and a series of impact assessments published 2015 and 2016. These included a transport system analysis (TSA) (Trafikförvaltningen, 2015d), a location impact assessment to analyse the route choice and land-use impacts (Trafikförvaltningen, 2015a), an environmental impact assessment summarising impacts on public health and the environment (Trafikförvaltningen, 2015b), a social impact assessment (SIA) aiming to summarise the impacts on social capital and equality (Trafikförvaltningen, 2015c). The SIA is of particular interest because it is the first of its kind in Sweden and to the author's knowledge unique in public transport infrastructure planning.

These documents were used as supplementary research data and to compare with findings from the interviews. Bowen (2009) claims that documents can have different uses as empirical material, including providing historical insights, as supplementary material, to verify or to contrast findings from other sources. Other potential uses of documents can be as a generator of interview questions and to track developments of policy over time. Although the primary use of the documents was to complement the interviews, the SIA and TSA were read superficially before the interviews to provide background knowledge. After the interviews, we read the documents in-depth in the light of previous research.

Quantitative methods

Papers 3, 4 and 5 use quantitative data and depart from regression analyses with the ambition to establish statistical *associations*. Further, paper 4 has a more ambitious task to establish a *causal* connection. The papers use different empirical techniques, and the purpose of this section is to briefly introduce the specific econometric model alongside references for more thorough reading, followed by a short explanation of the applications of the methods in the papers. Table 3 summarises the econometric models and the data sources used in the papers.

Table 3
Econometric models and data sources.

Paper	Econometric model	Data source	Description
3	Hedonic regression	Sampers	A Swedish transport forecasting system
		Svensk mäklarstatistik	Transaction prices and other attributes of single-family homes and apartments
4	Difference-in-differences	Microdata Online Access (MONA)	Micro-data (individuals) coordinated by Statistics Sweden
5	Fixed effects panel model	Microdata Online Access (MONA)	
		Lupp	Train movements on national railways in Sweden

Hedonic regression

Hedonic modelling is based on revealed preference. Transaction prices of real estate are useful for this type of analysis as these have some measurable attributes (such as the number of rooms and size), which can be understood as giving different levels of pleasure to individuals. The value, or price, of a real estate, can thus be assumed to represent an implicit price of its attributes (Eliasson et al., 2020; Rosen, 1974).

Accessibility is such an attribute that is difficult or impossible to evaluate directly. But since real estate is fixed in its location, it is thought to absorb the value of the location, which is estimated with accessibility indicators. Paper 3 uses the logsum measure as the accessibility indicator, which is derived from the Swedish transport forecasting system Sampers (see Algiers and Beser (2002) for details of the system). In short, the logsum is a utility-based accessibility measure. It contains information about the generalised transport costs with different transport modes to a broad set of destinations that constitutes an individual's choice set (Ben-Akiva & Lerman, 1985). This information is computed on many small geographical zones. The logsum is then a sum across the modes and trip purposes on zone level, after taking the logarithm of the equation.

In addition to accessibility, paper 3 analyses the substitutability measure as proposed by van Wee, Cranenburgh and Maat (2019). Substitutability is an indicator of the degree to which the accessibility of a location is built up by one or several

transport modes. At one extreme of this indicator, all modes are equally important, and at the other extreme one mode makes up the full accessibility.

The potential analytical improvement that substitutability brings is that we can address households' hedonic value for a location where more transport modes build up the accessibility. A location with one or more satisfactory back-up modes can be said to have more robust accessibility, because in the event that the preferred mode is unavailable, the accessibility does not collapse. We are therefore arguing that substitutability covers a qualitatively different attribute of a housing unit than accessibility does, namely a concern over worst-case scenarios.

These two variables are together with unit-specific attributes (living area, age, monthly fee, and plot area), analysed on real estate transaction prices. The model is semi-logarithmic with the dependent variable in logarithm.

We use transaction prices for single-family homes and apartments (about 10,000 transactions each) and estimate separate models for these. The data covers Skåne, in south Sweden, with approximately 1.4 million inhabitants, and comes from the organisation Svensk Mäklarstatistik (Swedish Realtor Statistics) for the years 2013 and 2014.

Difference-in-differences

The research design employed in paper 4, aims to model the causal effect of a specific policy explicitly. In contrast to “traditional” econometrics, which aims to specify a complete equation structure with the best possible model fit, Angrist and Pischke (2017) argue that “modern” econometrics does not aim to “explain” a variable “y”. Instead, it aims to analyse the causal relationship between a specific x and y (controlling for other x's) and focuses on eliminating selection bias.

We mentioned earlier that the qualitative methods in the thesis were used primarily to understand ex-ante appraisal and planning, but that one could have constructed models that, calibrated on data, could have been used to extrapolate outside the support of the data (Abadie & Cattaneo, 2018). In contrast to ex-ante evaluation, this section is considering ex-post causal inference. There are different causal research designs available, such as regression discontinuity design, instrumental variables, and various DD techniques. There are plenty of review papers on causal research designs (see e.g. Imbens and Wooldrige (2009), Athey and Imbens (2017), Abadie and Cattaneo (2018) and Wing, Simon and Bello-Gomez (2018)); thus we will not go into details about the methods.

The difference-in-differences approach aims to take into account the counterfactual trend of an individual: what trend would an individual follow if the policy would not have been imposed on her or him? The principal problem that needs to be addressed before running the test is that an individual is observed in only one state of the world. At any point in time, an individual is either “treated” or

“not treated”, never both. In order to address the counterfactual problem, paper 4 employs propensity score matching to find a set of control groups that are as similar as possible to the treated groups (see below).

Beyond the matching procedure, we address selection bias by analysing two separate datasets. The data comes from Statistics Sweden’s (SCB) Microdata Online Access (MONA) system, which is SCB’s tool for releasing census data (Vetenskapsrådet, 2014). Based on our calculations, we constructed the first dataset based on individuals that live within a defined area over the period of interest. In other words, we identified individuals with fixed residence and extracted repeated observations on these individuals. We constructed the second dataset by identifying individuals that moved to the defined areas each specific year. That is, for a specific year, we observe a set of individuals that move to a place of interest, and the next year we observe another set of individuals. Thus, with the latter dataset, we analyse the spatial sorting, or selection, effect. With the former dataset, we analyse the longitudinal effect.

Propensity score matching

Based on its theoretical roots (Holland, 1986; Rubin, 1974), propensity score matching has developed into a menu of different options. In paper 4 we estimate two different matching models in terms of the covariates included, which resulted in two different control groups. In both cases, we limited the possible control areas to towns with at least 200 inhabitants, without a railway station, and located in the same region as the treated towns in Skåne in south Sweden. This is done so as not to involve towns elsewhere that appear to be suitable matches in our data but differ in ways that we cannot account for. In the first model, we modelled the score on total population and population density. The second model also included the ratio of individuals having spent three years or more at university, the average number of cars per individual, and the average change in annual labour income.

Further, more technical menu options include the choice of matching algorithm and probability function (Ho et al., 2011). We used nearest neighbour matching and tested both logit and probit functions (with identical results). Nearest neighbour matching means that each treated unit is matched with the single best non-treated unit. An alternative matching algorithm, which gave near-identical results, is optimal matching, which optimises the matching across the full set of units.

Panel models

Panel data consists of repeated cross-sectional data. Broadly speaking, there are two ways of analysing such data, fixed effect (FE) or random effect (RE). FE panel models assume that the unobserved effects are heterogeneous and fixed over time (Angrist & Pischke, 2009). In practice, the FE model assumes a group-specific

constant term for each unique cross-sectional unit and calculates the deviations from means to remove the unobserved fixed effect. The merit with this approach is that it handles potentially omitted variables, but a demerit is that the estimates become inconsistent if the fixed effects are correlated with the regressors (Cameron & Trivedi, 2005; Greene, 2012).

An alternative approach is to assume that the unobserved individual effects are random variables (random intercepts) and independent of the regressors. In contrast to the within unit estimation in FE models, RE models are estimating the difference between units. Still, Cameron and Trivedi (2005) maintain that short panels make FE model estimates consistent.

In paper 5, we analysed the association between accessibility to jobs and labour income using a panel dataset that was constructed from two sources. One of the sources is the same as paper 4 builds on: SCB's census data on individuals in Sweden. The other source comes from the Swedish Transport Administration (named Lupp), which includes information on all train movements in Sweden, which amount to approximately 30 million per year.

The rail data from Lupp was used to identify the trips that are possible to make within a selected time interval using the Swedish railway network. We created an origin-destination matrix for possible train commutes during morning peak hours and then calculated a cumulative accessibility measure for each station in the network. The cumulative measure is a commonly used accessibility indicator in transport planning (Miller, 2018). We tested two different catchment areas of the stations: 800 metres and 1600 metres radius (Euclidean distance) from the coordinates of each station. The 800 metres, approximately a half-mile, is commonly used in transit-oriented development in the US and corresponds to a ten-minute walk at a speed of about 5 km/h (Guerra et al., 2012). Commercial properties are more sensitive to distance from rail stations than residential properties (Debrezion et al., 2007).

From SCB, we retrieved annual figures on labour income, employment status, education status, and the number of jobs at the origin and destination locations. The datasets overlap for the years 2011 through 2014, which gave us repeated cross-section (panel data) aggregated on geographical areas. As dependent variable we used pre-tax labour income among residents aged 20 to 64 at the origin, which was assumed to be a function of the number of jobs at the origin, the total number of jobs at accessible destinations, the employment rate among residents at the origin, and the rate of residents at the origin with three or more years at university or college.

Initially, we compared FE and RE models with a Hausman test (Greene, 2012), which indicated that FE was the preferred specification. We then continued to analyse two separate datasets. The first dataset was based on the actual railway network, as it developed over the years 2011 through 2014. The second dataset, on the contrary, assumed a fixed railway network on its 2011-status and only taking

into account changes in accessibility stemming from changes in job locations. The idea behind this second analysis was to examine a counterfactual situation where no changes would have been made in the network.

5 Findings

This chapter outlines the aims and presents the key findings of each paper in the thesis. The next chapter, Discussion, presents the synthesis of the results and address the thesis' aim and research questions.

Paper 1. The explorative study

Aim

The principal purpose of this study was to describe public transport appraisal practices in Sweden. In doing this, the aim was to provide an insight into how policy objectives are translated into action and to investigate how public transport measures are evaluated. More specifically, the study and analysis aimed to answer the following three research questions.

How are local and regional strategic public transport objectives in Sweden are translated into the actual measures taken?

How are local and regional Swedish public transport services evaluated in terms of the overarching strategies of public transport?

Are there potential areas of conflict?

The motivation behind the first two questions came from the public transport industry in Sweden, which demanded knowledge on the effects of transport on society and understanding of tools available to appraise effects. The paper takes an initial step in this search by understanding the present situation. The third research question sprung from previous literature which emphasised the importance of collaboration (Hrelja et al., 2016).

Findings

The main takeaway from this paper is that it was unclear as to how targets of the public transport operations contributed to overarching regional objectives. The interviewees expressed that this is indeed important in order to motivate the resources spent on public transport. It appeared to be an increasing concern at the

time of the study, in 2016, following the Public Transport Act in 2012 (SFS (2010:1065)). The act stipulated that all regions were obliged to produce a public transport provision program, including goals for the public transport supply.

The respondents stated that the objective of public transport was broadened after the Public Transport Act. One interviewee stated that the regional public transport goal before the act was focused on bringing people from point A to B. Today's goals, contrastingly, are concerned with the contribution of public transport to society. Several interviewees asked for more knowledge on relationships between public transport and for example economic indicators.

We found that the main objectives were to increase the market share of public transport in comparison to the private car and to provide a social service. The paper traced a change towards the view of public transport as a substitute to the private car rather than as a complement to it. This change seemed to be more applicable to smaller regions and was not apparent in the regions Stockholm and Skåne which had that perspective since before. Yet, the paper found that there is a trade-off between providing social services and focusing more on the strong links where revenue and ridership are.

The insights from the paper are generalisable to similar contexts as far as the kind of problem is concerned, but not its degree. The degree to which this insight is transferable has to be studied empirically.

It is not apparent that conceptions and models that fit a particular setting (for example, national planning) is directly transferable to another setting. Regional public transport planners working to adapt supply to fit urban and regional policies have another set of problems and tools at their disposal than national transport planners. At the same time, regional politicians do not request a complete CBA since they do not have the time or competence to comprehend the results in a standardised CBA.

The main contribution of this study is that it explicitly concerns regional public transport appraisal practices and tries to understand the role of appraisal tools.

Paper 2. The case-study

Aim

The aim with paper 2 was to elaborate on the use of appraisal tools, i.e. the kinds of tools employed and at what stage they enter the planning process. In addition, the aim is to discuss where there might be scope for improvement of CBA and the TSA. This is done by looking at a light rail project in Stockholm, where we studied planning documentation and interviewed persons involved in the planning process. The research questions are: What is the role of appraisal methods in this project and

how concordant are they with the planning procedure? Can the appraisal methods be improved, and if so, in what aspects?

Findings

This case study sheds light on motivations behind large public transport schemes. We find that the light rail project Spårväg syd is tightly coupled with municipal ambitions and has roots back in time. The study concludes that the project was politically motivated and that it is a case in point where the solution presents itself before the problem.

A recurring statement in the literature is that the timing of the CBA is a problem, i.e. that the CBA tends to arrive after opinions are formed. Besides, this paper finds that there is a problem as to what the CBA is commissioned to assess and that this can have an impact on how the method is perceived. The interviewees claimed that potential bus traffic improvements could have substantial social benefits compared to costs, but that cost-benefit analyses of bus projects are few.

The social impact assessment of this project is of particular interest as it is one of the first of its kind. While the interviewees stated that it is a valuable complement to the CBA in principle, they were sceptic in this particular case because the assessment did not compare the social impacts across project alternatives.

The case study also discerns that one of the principal motivations for the light rail scheme is to structure future development in the area. The project seems not to be grounded in improving accessibility per se, but as a means to develop the area jointly with the municipalities. The regional transport policy is concerned with linking regional urban cores in Region Stockholm with high-quality public transport.

Paper 3. An implication of uncertainty

Aim

The paper aimed to estimate the option value in transport. The idea of option values for transport services date back to the 1960s, and conceptual and empirical work has been conducted during the last few decades. The purpose of this paper was to discuss how the option value is related to accessibility and connect it to the concept of substitutability (van Wee et al., 2019). We advance the idea that a measure of substitutability represents the value of having substitute transport modes. In other words, the substitutability measure is an indicator of the total option value at a specific location.

Findings

The paper found that a positive association between accessibility and real estate prices, consistent with previous literature. Also, the paper found that substitutability is positively associated with real estate prices, and the variable significantly improves the model's explanatory power of the variation in real estate prices. Unfortunately, we are not able to interpret the estimates of accessibility and substitutability straightforward in terms of its marginal effects on prices. We can only say that one substitutability score is *better* than another, but not by *how much*.

Still, the estimates suggest that households favour variety; for a given level of accessibility, households seem to prefer more transport options to fewer. The implication is that while the logsum measure of accessibility adds the value of all transport options on top of each other (i.e. additional opportunities are always positive), it does not distinguish an accessibility score built up entirely by car to accessibility where modes contribute more equally.

How generalisable these estimates are across contexts is difficult to say. More empirical work is needed. We argue, however, that the theory of the option value holds across contexts.

Paper 4. Focus on causality

Aim

Paper 4 aimed to gain insights into two different narratives of regional economic development. On the one hand, regional and local policy is driven by the narrative that the labour market widens and thickens with better accessibility by rail. That is, given a certain location of residents and workplaces, better accessibility improves the labour market performance.

The other narrative concerns attraction of skilled workers around commuter train stations. This narrative thus concerns the composition of individuals of a given place at different points in time, and analytically we want to answer the question if the new residents differ after the train station compared to before. This paper departed from the following two research questions.

Is there a treatment effect of train stations on individual annual labour income for people living in the catchment area of the station?

Can we trace an effect, in terms of annual labour income, of train stations on people migrating to the catchment area of the station?

Findings

Neither the results of the first nor the second research question suggests any conclusive evidence of an effect of train stations on annual labour income. Curiously, some of the estimates of the first research question indicated a negative effect, meaning that locations with train stations experienced a decrease in labour income as an effect. Further analyses of this discovered that the male subset of the population drove it, and separate analyses of the matched pairs showed that three of the ten pairs carried the negative sign. Contrastingly, another model of the same dataset, which assumed that the potential treatment effect is unique for each year (instead of a unitary potential effect) indicated no causal relation.

There are some plausible reasons as to why few estimates carry the expected positive sign. One reason could be that the period of five years after the station establishments is a too short period for the effects to be distinct. The practical problem with extending the dataset further in time is that the number of individuals drops, and the dataset shrinks as a consequence. In other words, the panel becomes longer and narrower. Another reason could be that the accessibility improvement is marginal. This issue is partly addressed in models where we only included the subset of individuals without a registered car throughout the study period, but the estimates of these models still indicate zero treatment effect. Yet, there are of course possibilities that the places treated with a train station had bus services removed or significantly cut, which reduced the accessibility in some directions.

The findings concerning the second research question of this paper indicate that there is no general effect of train stations. The exception is the model where the treatment effect is assumed to be unique for each year. In this model, a few of the estimates were positive and significant. Further analyses into the matched pairs indicate that one of the matched pairs is driving the effect. Interestingly, it is one of the pairs that indicated a negative effect on the first research question.

The general conclusion of this paper is that there is no evidence for a causal effect of train station infrastructure on labour income on either the fixed residents or the residents that the towns attract. The few significant estimates that show up should be interpreted cautiously. Because of the large number of regressions, there is a risk of false-positive estimates.

Paper 5. The railway network and labour market outcomes

Aim

The motivation for this study came from a discussion at a Thredbo conference, which highlighted that more longitudinal studies were needed (Venter & Leong, 2018). While the conference report explicitly discussed “wider impacts”, this paper does not imply that results are wider than the user benefits. This paper aimed to investigate the association between job accessibility via the railway network in Sweden and local annual labour income levels using longitudinal data. An additional aim was to compare the outcome with the actual railway network between 2011 and 2014 with a hypothetical network fixed at 2011. What could we say about the difference that infrastructure and train service changes made on accessibility to jobs? The accessibility of specific locations can change for other reasons than changes in the transport system, so the purpose was to understand the contribution of the changed railway network.

Findings

Paper 5 analyses three different time thresholds of the cumulative accessibility measure: 30, 45 and 60 minutes. In addition to panel data models, the paper also analyses cross-sectional models for each year in the study. The results of the cross-section-models indicate a weak connection between the number of jobs accessible through the railway network and pre-tax labour income. The estimates tell that, for every 1000 jobs available at destinations, there is an increase in labour income by 0.1 per cent, and for every 1000 jobs available at the origins, there is a labour income increase of 0.2 per cent. The estimates on education and employment also indicate significance, and expected signs: higher education level and employment rate imply higher labour incomes. The population variable was insignificant.

The fixed-effects panel data models indicate no significant destination job effect, but an effect of 0.5 per cent higher labour incomes for every 1000 jobs at the origin. The control variable on education indicates a positive and significant effect, but the population variable, unexpectedly, indicates a negative and significant effect. According to theory, higher demand for housing could drive up prices of real estate and lead to buyers with higher income, unless it is balanced off by more construction. Also, people with higher income might demand larger dwellings, and therefore not choose to live near the most densely populated station areas.

6 Discussion

This chapter provides answers to the research questions. Recall that the overall aim of the thesis is *to investigate the knowledge problem in regional public transport planning in order to increase the general understanding of appraisal and evaluation of public transport measures and contribute with empirical observations on public transport planning and effects of transport accessibility in Sweden*. The titles in this chapter contain each research question.

What are the tasks of regional public transport, and how is it thought to contribute to societal goals?

Outputs and outcomes

Public transport planning in Sweden is organised under regional authority, and its objectives are traced to those of the region in general. These over-arching regional objectives define the choice set of the PTA. In some cases, paper 1 concludes, the public transport objectives are defined as measurable targets, for instance, the cost recovery of the operations (i.e. the relative amount of variable costs that are covered by variable revenues). Other public transport objectives take the form of, for instance, structuring the built environment.

We can distinguish between output and outcome measures (Jackson, 2011). Outputs are defined in terms of the transport supply itself (e.g. the number of trips), whereas outcomes are defined in terms of the impacts of the transport supply (e.g. structuring the built environment). Paper 1 traced a change in the task of public transport towards putting more emphasis on the impact on society. Previous research found the same (Stjernborg & Mattisson, 2016).

The tasks of regional public transport, as found in paper 1, could be divided into three broad categories. The first task can be labelled “mass transport”, and is focused on trunk lines, where the aim is to compete with the private car. Commuter trains, bus rapid transit, and buses of a high level of service running with frequent departures are examples of this. The second task can be called “social transport”, and it is directed at providing a minimum level of service. The demand in certain areas is so thin that substantial subsidisation is required, and the supply is thus motivated as a social service.

These two tasks can be said to be demand-driven, i.e. the supply is adjusted based on the level of demand. The third task, which is a synthesised result of paper 1 and 2, could be labelled “land-use structuring transport” and its purpose is to drive demand. This task of regional public transport is aimed at being integrated with, and having an impact on, property markets and their development.

Paper 2 arrives at a discussion that Spårväg syd in Region Stockholm is not a transport solution only, but a project aimed to establish a strong link between two urban cores and spur development along the route. De Bruijn and Veeneman (2009) argue that a light rail project can be a way to create momentum by bringing actors together. Since the transport network already is good in the area where Spårväg syd is planned, there is not a need, in terms of accessibility, to establish new infrastructure. But the prevailing narrative Stockholm is that of a growing region that has ambitions to be a leading metropolitan area in Europe. The light rail scheme is connected to a norm where the urban cores in the regions are linked by some kind of rail technology. Accordingly, the Spårväg syd project cannot be fully discussed without addressing the decision to pinpoint these regional cores in regional strategic development plans. It is a case in point when a systematic CBA is not sensitive to particular contexts (Mackie et al., 2014).

Conflicts of interests

The shift in focus from outputs to outcomes brings considerations of the impact public transport has on other sustainable transport solutions. Regional public transport authorities do not only have a priority to increase the number of public transport trips; the new public transport trips should not be a replacement for cycling or walking. With a broader role to play also insights into potential areas of conflict come.

Paper 1 concludes that there are two main conflicts in public transport planning. The first conflict concerns the broader role that public transport has today, which results in different goals that are potentially in conflict with each other. With scarce resources, prioritisations between goals of attracting commuters in the strong links, and upholding services for the low passenger volumes must be made. The other one concerns the conflict of interests between organisations that plan for the transport system. The objectives of municipalities that plan the local infrastructure might deviate from the objectives of a regional transport authority.

Parallel to the trend of a more comprehensive look at transport among regional transport planners, there are possibilities that local transport planners have not the same view. There is a disjoint in planning, which was discussed already by Braybrooke and Lindblom (1963). Even if both organisations share the same underlying interest regarding, for instance, sustainable transport, there might be conflicts. An example from paper 1 highlights a situation where the PTA wanted to re-route some of its bus lines in order to free up resources that could be spent elsewhere in the system. However, the PTA must rely on the municipality to chip in

resources for the bus stops, and it turned out that the municipality was not willing to do that. Perhaps they had other sustainability measures higher in the priority list. My example here is similar to the example in Simon's (1978) Nobel Memorial lecture, in which he explained that the qualitative notions of production functions of the two municipality departments in the city of Milwaukee were mutually incompatible. They did not agree on the means to arrive at a shared goal.

On this note, there is a need for a better understanding of the action arena, to use Ostrom's (2005) terminology. In a problem that crosses the borders of authorities, there seems to be a lack of formal rules. Instead, it seems to depend on the capacity of the individual planners.

How are the strategic goals of regional public transport guiding the use of appraisal?

Nationally in Sweden, this question has a rather straightforward answer. The Transport Administration appraises each project based on a CBA and analyses how well each project aligns with the national goals. Combined, this forms a total impact assessment ("Samlad Effektbedömning" in Swedish). On the regional level, the question does not have a simple answer, a motivation to conduct paper 1. One generally guiding principle, found in paper 1, seems to be to keep appraisal as simple as possible. Since information is costly, and the organisations (except Region Stockholm) do not have in-house expertise on appraisal tools, more rigorous assessments are procured for particular projects. One has also to bear in mind that regional authorities have not had resources to procure the development of a regional transport model in order to produce a reference (do-nothing) forecast.

There are two ways to continue the answer to this research question. The first one is answering it from a general planning perspective, which defines most of the work that is done by the regional public transport authorities. The other way of answering is to highlight specific projects.

General policy assessments

Paper 1 finds that policies are commonly assessed regarding the impact on the budget. Keeping the budget thus guides the assessments to ensure that the supply is minimising losses; an important part of the analytical work. Hence, efforts are made to analyse the number of trips to understand where demand exists as we noted in the previous section. There are exceptions to this loss-minimisation in the context of low-demand supply in sparsely populated areas. These services are considered to serve a social need and relate to an idea of a minimal service definition.

Paper 1 concludes that regional public transport decision-making takes the form of backcasting. This is a concept where a future scenario is aimed at, and policy is formulated in order to meet the conditions that the future scenario requires. This

type of decision-making is indeed similar to the synoptic process outlined in the framework chapter, but with a difference that the “intelligence” step is focused on the future scenario rather than the current situations and problems. In paper 1, interview respondents state that they set goals on a general level such as a market share of public transport compared to other motorised modes, and work with hammering out policies that, according to their judgments and experience, lead in a preferred direction.

As we noted in answer to the previous research question, the goals of the transport supply have lately put more emphasis on outcome measures, which place higher demands on the appraisal work. More distant goals, such as regional economic growth or the structuring impact on land-use, require more sophisticated analytical models. The dilemma is, however, as the framework elaborated, that these causal links are hard, if not impossible, to estimate ex-ante. Such models would regardless put many PTAs out of their depth. They would need more analytical resources, leading to yet more trade-offs.

Still, regional public transport authorities rarely invest in large projects (Vigren & Ljungberg, 2018), except for system-wide fare structure changes. The costs of acquiring information have to relate to the benefits of each policy proposal. The ability to produce reference forecasts could be useful in order to strengthen the work with backcasting. Thus, PTAs need knowledge of their general transport supply and what an overall change in fare structure would cause in terms of trips made and the consequences for operation costs.

Specific project assessments

Sometimes the PTAs get involved in larger projects. Paper 2 discussed that a central motivation for Spårväg syd is to connect the regional urban cores. Here we see traces of backcasting. Strategy documents state the light rail solution early, making this a case where the means come to attention, rather than the ends (Braybrooke & Lindblom, 1963). Consequently, rather than analysing how the future aspirations best (and most efficiently) can be met, the scenario already includes a light rail link which makes it challenging to introduce alternative solutions later on (Priemus, 2008).

Spårväg syd also makes a good example where the motivations of a project determine the analyses. In paper 2, we saw that the demand for more assessments comes from the objectives that the project is aimed to contribute to. In the case of Spårväg syd, the social impact assessment (SIA) comes out of a stated ambition to improve the social inclusion in the Stockholm region (RUFSS 2010, 2010). The motives behind the project were also about housing. Thus, it comes naturally to analyse the land-use impacts of the project in a separate impact assessment. The location impact assessment states that the light rail project should be regarded as a project that integrates planning of land-use and transport (“samhällsplanering” in Swedish) (Trafikförvaltningen, 2015a).

I claim that this is problematic. An ideal to strive for in transport planning is to define the types of assessments to be produced *before* any solution has been explicitly mentioned in strategies for the future. I, therefore, concur with Priemus (2008) that the focus should be on the problem (or estimated deficit in terms of a future preferred scenario), not the solution. After concluding that the problem can be solved with new infrastructure, the next step is to think about alternative solutions to the problem. More than one road leads to Rome, and a deficit in transport infrastructure can be remedied in different ways.

In cases where a solution is indicated before a problem has been articulated, there is a likelihood that the proposed solution gets more analytical resources and focus than alternative solutions, as seen in paper 2. The SIA was focused on finding support for the light rail project, and without thoroughly comparing it with alternatives. Here we find a major point of improvement. The SIA makes an argument of weighing up the benefits of the light rail project without providing insights into possible overlaps with the benefit side of the CBA, and without arguing how the findings in the SIA compares to the costs. Further, in order to get an idea of the unique impacts of the light rail, all assessments must be done for each project alternative.

Thus, when assigning resources to project assessments, it is quintessential to make sure that multiple solutions get equal attention and analytical resources. If, as in the case of Spårväg syd, the project is supposed to revitalise neighbourhoods and spur house construction, there could be more alternative solutions than transport solutions alone.

How can accessibility be defined and analysed in a regional public transport setting?

Paper 3 discusses accessibility from a decentralised person-based point of view, while papers 4 and 5 discuss it from a location-based perspective. The answer to this question is divided into two subsections: one subsection discussing accessibility and useful applications in decision-making, and a second subsection discussing substitutability as a bridge between accessibility and the option value.

Accessibility

In paper 5, we state that there is no best accessibility measure. It depends on the purpose of the research or goals of the administration. Central features of an accessibility measure are communicability, interpretability, theoretical basis, and as an indicator for social inclusion (Geurs & van Wee, 2004). There is a trade-off between theoretical basis and communicability. Accessibility measures that are easy to interpret and produce may have an essential role as a component in evaluation for transport planners.

The motivation for papers 4 and 5 came out of a conception in Sweden that rail accessibility contributes to economic benefits. It also follows from a demand by the PTAs to know the effects of rail transport supply. Paper 4 builds on a place-based accessibility score that takes only two values. Either an individual observation has accessibility to a rail station, or not. Paper 5 builds on cumulative accessibility, also a place-based measure. While accessibility, in general, is a key parameter for economic activity and property values, the results indicate that new projects are likely to contribute only marginally to total accessibility.

It is thus crucial to recognise that accessibility can change in other ways than through transport improvements (a finding in paper 5). Given a specific transport network, the fact that firms move, expand, or downsize changes the accessibility to jobs (also discussed in Bohm et al. (1974)). The land-use component in an accessibility measure is, therefore, of importance in order to synthesise the effects of both the land-use system and the transport network (Levinson et al., 2017).

On the individual level of accessibility, the logsum measure (used in paper 3) is based on a welfare economic foundation (de Jong et al., 2007). It is a theoretically appealing measure, but less intuitive. Further, the logsum does not fully account for the “love of variety in consumption” (van Wee, 2016, p. 13), which we turn to next.

Substitutability

Substitutability is a new concept in transport research (van Wee et al., 2019). It has a direct link to accessibility, but with the difference that while accessibility is an index of the possible destinations that an individual can reach with different transport modes, substitutability asks to what degree a particular transport mode (or destination) can be substituted with another mode (or destination) without reducing the level accessibility. That is to say, to which degree is one or several modes forming the accessibility.

While welfare economic theory stipulates that individuals know all their choice alternatives, the utilities attached to these and maximise utility, in reality, individuals cope with the presence of uncertainty and make choices that are good enough. A discussion topic in paper 3 is that individuals or households react to uncertainties about the future. Remember the option value, which originates from an idea that people faced with uncertainty may prefer to hedge their bets (Lindsay, 1969; Weisbrod, 1964).

Uncertainty arises from different sources about individuals themselves and their surroundings. People move their nest infrequently, which makes it likely that they value a diverse accessibility portfolio to hedge for changes in preferences or life situation. People can also be willing to keep transport modes available for future use. This could be exemplified with a situation where a destination is certain but a back-up (optional) transport mode is demanded.

Paper 3 concludes that computing the substitutability measure is a small step to take for the analyst that already has computed the logsum. With knowledge from

the answers to research questions 1 and 2, this is most likely not part of the everyday work of a regional public transport planner. Nevertheless, in those cases where a PTA procure consultant services, this could be included in order to illustrate those areas where people are dependent on one transport mode.

A final point of discussion concerns to the extent to which individuals (or households) care about the worst-case accessibility. Opposition to removing bus services in the countryside could be an indication of this, and higher fuel prices were an initiating factor for the yellow vest movement in France. Individuals in the countryside could have a willingness to pay, over the use-value, to keep their substitute (bus) available for future demands, and people in the French countryside rarely have a substitute transport mode.

What is the relationship between accessibility and economic indicators?

Economic impacts are defined in terms of outcomes that are measured in monetary terms and do not need market simulation. The relationship between accessibility and economic activity is established in the empirical literature (Holmgren & Merkel, 2017; Melo et al., 2013, 2017). However, causal links are complex to trace. Laird and Venables (2017) argue that these mechanisms are context-specific in terms of the type of project, location, and time.

The findings in papers 4 and 5 are in line with previous literature. Paper 5 indicates that there is a positive but weak relationship between job accessibility (through the railway network) and annual labour income. On the contrary, the causal links are not easy to trace, as is found in paper 4.

Börjesson et al. (2019) argue that within a well-developed transport system, additional accessibility is likely to be marginal. Again, in the same way as the answer to the previous research question, it is worth emphasising that accessibility can change as a consequence of other reasons than transport measures. Further empirical evidence points in the direction that there are trends of spatial sorting of individuals with a certain educational background into different cities (Behrens et al., 2014).

An analysis of the relationship between two variables must include a discussion about counterfactuals. A naïve ex-post look at a trend of a variable may indicate that a preceding action improved the trend of that variable. In empirical research, it is crucial to stress the possible counterfactual courses that history could have taken. Paper 4 addresses this issue with the difference-in-differences technique, which is an attempt to ex-post account for a counterfactual situation.

The counterfactual perspective is also critical for ex-ante public transport decision-making. Planning for a future scenario, must not depart from an idea that only one course of action can result in the desired scenario.

7 Conclusions

Public transport policy is a multidisciplinary field consisting of a mix of disciplines including engineering, economics, geography and politics. The thesis has its roots in economics, but a broader perspective of economics than the welfare economic research program. The thesis has also invoked ideas on public administration and transport policy from other fields than economics. Discussions on transport policy require a multitude of academic disciplines. Transport research would benefit if more researchers tried to step outside of their comfort zones of and see the virtues of other perspectives. In order not to get stuck on different sides of an argument, each researcher and expert should carefully study the best ideas of other disciplines.

How can we understand appraisals and evaluation in public transport? The answers to research questions 1 and 2 give some implications. First, the objectives of public transport are at the output level easy and clearly stated, such as ridership and market share. This implies a rather simple appraisal work and follow-up evaluations. Other objectives, on the contrary, take the form of outcomes, which adds complexity to the topic that is supposed to be analysed. It carries less distinct feedback to the decision-maker, perhaps impossible to measure adequately.

The increasing body of empirical research indicates evidence of absence concerning causal effects of changed transport cost on labour income, for instance, in contrast to the notion of an absence of evidence. In many countries, the existing transport infrastructure is already well developed and adding new projects will only have a marginal effect on total accessibility. It is the changes in accessibility that determine the principal benefits of a project, not how many kilometres of road or railway it consists of, or its monetary outlay (Börjesson, 2019).

Still, the task of public transport might not necessarily be to improve total accessibility in any substantial way. The thesis concludes that regional public transport can be subject to three different tasks (without mutual order): mass transport, social transport and land-use structuring transport (see elaboration on research question 1). The case Spårväg syd is an illustration of the third task, namely that a public transport project can be applied to have a structuring impact. A CBA will, in these cases, indicate that it is not a worthwhile project if it does not improve accessibility, and economists will rightfully express that development could have happened either way.

Likewise, the first and second tasks of public transport do not necessarily aim at improving accessibility in an aggregated way. It could be to offer a service to

specific groups of individuals in certain locations even though it might be a loss-making affair, or to compete with private vehicles, which sometimes lead to unwillingly competing with walking and cycling.

The chief points that I want to drive home are that as long as the process of arriving at particular policy objectives, tasks and motives are transparent and open for all, and so long that the rules of decision-making are clear and followed, it is not much up to researchers or experts to say what is to be done. Scientific inquiry has a role to play in the analysis of the institutions and rules that guide decision-making processes, in gathering evidence and disseminating meaningful factual relationships, and in analysing and explaining which trade-offs and uncertainties there are regarding fulfilment of objectives.

In a democratic society, markets and politics have in common that they are processes where free individuals act based on a multitude of reasons. We need markets because we do not know the efficient level of production and consumption in society, and we need politics because we do not know the distribution of opinions in society. These processes take place in environments with particular laws, rules, and norms, because society, I argue, is an abstract order without any particular results to be achieved.

Contribution of the thesis

The novelty of the thesis is that it is an attempt to go the full length of public transport policy: from the planners' perspectives to analyses of transport impacts. The empirical contribution consists of the observations of practices among a few PTAs in Sweden together with a case study. Qualitative in-depth interviews have given insights that can be useful for economists in their search to provide appraisal tools that apply to decision-making.

Another empirical contribution is the quantitative indication that both accessibility and the substitutability (the degree to which the accessibility is built up by one transport mode) are positively associated with property values. This finding has the potential to open up for further research on the topic. People are valuing not only accessibility but also the reliability, or robustness, of accessibility.

The theoretical contributions come as a result of the combination of the papers and the framework in this cover essay. Transport appraisal cannot operate separately from the organisations that it is supposed to aid. The thesis contributes to an understanding of the role of both facts and value in public transport policy. An appraisal that does not relate to prevailing regional ambitions is of limited use for decision-makers.

Further research

More empirical research on possible relationships between transport and labour market outcomes and the real estate values is always needed, and meta-studies on top of that. Empirical research situated in various contexts using different methods will continue to constitute a crucial source of knowledge.

The most tangible direction in terms of further empirical work is the emerging concept of substitutability. We lack knowledge about its potential significance in more regions and countries when it comes to the attractiveness of a location. Are the results generalisable? If so, then we can tie substitutability more closely to option value theory.

The thesis has elaborated and problematised on the role of public transport in society and the implications for standardised appraisal methods. I believe more fruitful research can be done concerning actual decision-making processes: we can learn more about how project alternatives that end up for assessments have been generated. The generation of ideas demands a degree of creativity. Further, economists can do more work in understanding the trade-offs that decision-makers focus on, and underline the critical trade-offs that the decision-makers seem to overlook.

References

- AB Storstockholms Lokaltrafik. (2012). *Förstudie Spårväg syd - Slutrapport*.
- Abadie, A., & Cattaneo, M. D. (2018). Econometric Methods for Program Evaluation. *Annual Review of Economics*, 10(1), 465–503. <https://doi.org/10.1146/annurev-economics-080217-053402>
- Ahlfeldt, G. M., Redding, S. J., Sturm, D. M., & Wolf, N. (2015). The Economics of Density: Evidence From the Berlin Wall. *Econometrica*, 83(6), 2127–2189. <https://doi.org/10.3982/ecta10876>
- Algers, S., & Beser, M. (2002). SAMPERS - The new Swedish national travel demand forecasting tool. In L. Lundqvist & L. G. Mattsson (Eds.), *National Transport Models. Advances in Spatial Science*. Springer. <https://doi.org/10.1007/978-3-662-04853-5>
- Alvesson, M. (2011). *Interpreting interviews*. London: SAGE.
- Alvesson, M., Gabriel, Y., & Paulsen, R. (2017). *Return to Meaning: A Social Science with Something to Say*. Oxford University Press. <https://doi.org/10.1093/oso/9780198787099.001.0001>
- Alvesson, M., & Sköldbberg, K. (2009). *Reflexive methodology: New vistas for qualitative research*. London: SAGE.
- Alvesson, M., & Sveningsson, S. (2003). Good visions, bad micro-management and ugly ambiguity: Contradictions of (non-)leadership in a knowledge-intensive organization. *Organization Studies*, 24(6), 961–988. <https://doi.org/10.1177/0170840603024006007>
- Andersen, S. N., Díez Gutiérrez, M., Nilsen, Ø. L., & Tørset, T. (2018). The impact of fixed links on population development, housing and the labour market: The case of Norway. *Journal of Transport Geography*, 68(April), 215–223. <https://doi.org/10.1016/j.jtrangeo.2018.03.004>
- Andersson, H. (2018). Application of BCA in Europe-Experiences and Challenges. *Journal of Benefit-Cost Analysis*, 9(1), 84–96. <https://doi.org/10.1017/bca.2018.5>
- Andersson, H., Hultkrantz, L., Lindberg, G., & Nilsson, J.-E. (2018). Economic Analysis and Investment Priorities in Sweden's Transport Sector. *Journal of Benefit-Cost Analysis*, 9(1), 120–146. <https://doi.org/10.1017/bca.2018.3>
- Andersson, M., Brundell-Freij, K., & Eliasson, J. (2017). Validation of aggregate reference forecasts for passenger transport. *Transportation Research Part A: Policy and Practice*, 96, 101–118. <https://doi.org/10.1016/j.tra.2016.12.008>
- Angrist, J. D., & Pischke, J.-S. (2009). *Mostly Harmless Econometrics: An Empiricist's Companion*. Princeton: Princeton University Press.

- Angrist, J. D., & Pischke, J. S. (2017). Undergraduate econometrics instruction: Through our classes, darkly. *Journal of Economic Perspectives*, 31(2), 125–144. <https://doi.org/10.1257/jep.31.2.125>
- Asplund, D., & Eliasson, J. (2016). Does uncertainty make cost-benefit analyses pointless? *Transportation Research Part A: Policy and Practice*, 92, 195–205. <https://doi.org/10.1016/j.tra.2016.08.002>
- Athey, S., & Imbens, G. W. (2017). The state of applied econometrics: Causality and policy evaluation. *Journal of Economic Perspectives*, 31(2), 3–32. <https://doi.org/10.1257/jep.31.2.3>
- Banister, D. (2008). The sustainable mobility paradigm. *Transport Policy*, 15(2), 73–80. <https://doi.org/10.1016/j.tranpol.2007.10.005>
- Banister, D. (2011). The trilogy of distance, speed and time. *Journal of Transport Geography*, 19(4), 950–959. <https://doi.org/10.1016/j.jtrangeo.2010.12.004>
- Banister, D., & Thurstain-Goodwin, M. (2011). Quantification of the non-transport benefits resulting from rail investment. *Journal of Transport Geography*, 19(2), 212–223. <https://doi.org/10.1016/j.jtrangeo.2010.05.001>
- Barfod, M. B., & Salling, K. B. (2015). A new composite decision support framework for strategic and sustainable transport appraisals. *Transportation Research Part A: Policy and Practice*, 72, 1–15. <https://doi.org/10.1016/j.tra.2014.12.001>
- Bastiat, F. (1995). *Selected Essays on Political Economy*. The Foundation for Economic Education, Inc.
- Beaudry, C., & Schiffauerova, A. (2009). Who's right, Marshall or Jacobs? The localization versus urbanization debate. *Research Policy*, 38(2), 318–337. <https://doi.org/10.1016/j.respol.2008.11.010>
- Becker, G. S. (1965). A Theory of the Allocation of Time. *The Economic Journal*, 75(299), 493–517. <https://doi.org/10.2307/2228949>
- Becker, G. S. (1993). Nobel lecture: the economic way of looking at behavior. *Journal of Political Economy*, 101(3), 385–409.
- Behrens, K., Duranton, G., & Robert-Nicoud, F. (2014). Productive cities: Sorting, selection, and agglomeration. *Journal of Political Economy*, 122(3), 507–553. <https://doi.org/10.1086/675534>
- Ben-Akiva, M., & Lerman, S. R. (1985). *Discrete Choice Analysis: Theory and Application to Travel Demand*. Cambridge, MA: MIT Press.
- Berger, T., & Enflo, K. (2017). Locomotives of local growth: The short- and long-term impact of railroads in Sweden. *Journal of Urban Economics*, 98, 124–138. <https://doi.org/10.1016/j.jue.2015.09.001>
- Beria, P., Debernardi, A., & Ferrara, E. (2017). Measuring the long-distance accessibility of Italian cities. *Journal of Transport Geography*, 62(June 2016), 66–79. <https://doi.org/10.1016/j.jtrangeo.2017.05.006>
- Beria, P., Giove, M., & Miele, M. (2012). A comparative analysis of assessment approaches. Six cases from Europe. *International Journal of Transport Economics*, 39(2), 185–217. <https://www.jstor.org/stable/42747972>

- Beria, P., Maltese, I., & Mariotti, I. (2012). Multicriteria versus Cost Benefit Analysis: A comparative perspective in the assessment of sustainable mobility. *European Transport Research Review*, 4(3), 137–152. <https://doi.org/10.1007/s12544-012-0074-9>
- Berry, J. M. (2002). Validity and Reliability Issues in Elite Interviewing. *Political Science and Politics*, 35(4), 679–682. <http://www.jstor.org/stable/1554809>
- Bertaud, A. (2018). *Order Without Design: How Markets Shape Cities*. Cambridge, MA: MIT Press.
- Bertrand, M., Duflo, E., & Mullianathan, S. (2004). How much should we trust difference-in-differences estimates? *The Quarterly Journal of Economics*, February, 249–275.
- Beukers, E., Bertolini, L., & Te Brömmelstroet, M. (2012). Why Cost Benefit Analysis is perceived as a problematic tool for assessment of transport plans: A process perspective. *Transportation Research Part A: Policy and Practice*, 46(1), 68–78. <https://doi.org/10.1016/j.tr.a.2011.09.004>
- Beukers, E., Bertolini, L., & Te Brömmelstroet, M. (2015). An assessment of interventions for improving communication and trust in cost benefit analysis processes. *Impact Assessment and Project Appraisal*, 33(1), 28–42. <https://doi.org/10.1080/14615517.2014.941142>
- Boardman, A., Greenberg, D., Vining, A., & Weimer, D. (2014). *Cost-Benefit Analysis: Concepts and Practice*. Harlow: Pearsons.
- Bohm, P., Bruzelius, N., Hesselborn, P.-O., Johannesson, M., Ruud, T., & Thedéen, T. (1974). *Transportpolitiken och Samhällsekonomin*. Stockholm: Liber Förlag.
- Bondemark, A., Sundbergh, P., Tornberg, P., & Brundell-Freij, K. (2020). Do impact assessments influence transport plans? The case of Sweden. *Transportation Research Part A*, 134, 52–64. <https://doi.org/10.1016/j.tr.a.2020.02.002>
- Börjesson, M. (2019). *Kan investeringar i transportinfrastruktur öka produktivitet och sysselsättning?* Stockholm: SNS Förlag.
- Börjesson, M., & Eliasson, J. (2019). Should values of time be differentiated? *Transport Reviews*, 39(3), 357–375. <https://doi.org/10.1080/01441647.2018.1480543>
- Börjesson, M., Isacson, G., Andersson, M., & Anderstig, C. (2019). Agglomeration, productivity and the role of transport system improvements. *Economics of Transportation*, 18, 27–39. <https://doi.org/10.1016/j.ecotra.2018.12.002>
- Börjesson, M., Jonsson, R. D., Berglund, S., & Almström, P. (2014). Land-use impacts in transport appraisal. *Research in Transportation Economics*, 47(1), 82–91. <https://doi.org/10.1016/j.retrec.2014.09.021>
- Boulding, K. E. (1971). After Samuelson, Who Needs Adam Smith? *History of Political Economy*, 3(2), 225–237. <https://doi.org/10.1215/00182702-3-2-225>
- Bowen, G. A. (2009). Document analysis as a qualitative research method. *Qualitative Research Journal*, 9(2), 27–40. <https://doi.org/10.3316/QRJ0902027>
- Braybrooke, D., & Lindblom, C. E. (1963). *A Strategy of Decision*. New York: Free Press.
- Brinkmann, S., & Kvale, S. (2015). *Interviews: Learning the craft of qualitative research interviewing* (3rd ed.). London: SAGE.

- Bristow, A. L., & Nellthorp, J. (2000). Transport project appraisal in the European Union. *Transport Policy*, 7, 51–60.
- Browne, D., & Ryan, L. (2011). Comparative analysis of evaluation techniques for transport policies. *Environmental Impact Assessment Review*, 31(3), 226–233. <https://doi.org/10.1016/j.eiar.2010.11.001>
- Buchanan, J. M. (1959). Positive Economics, Welfare Economics, and Political Economy. *The Journal of Law and Economics*, 2, 124–138.
- Buchanan, J. M. (1964). What Should Economists Do? *Southern Economic Journal*, 30(3), 213–222. <http://www.jstor.org/stable/1055931>
- Buchanan, J. M. (1999). Cost and Choice: An Inquiry into Economic Theory. In *The Collected Works of James M. Buchanan Volume 6*. Indianapolis: Liberty Fund. https://doi.org/10.1007/978-0-306-47828-4_69
- Buchanan, J. M. (2000). Politics as Public Choice. In *The Collected Works of James M. Buchanan Volume 13*. Carmel: Liberty Fund.
- Buchanan, J. M., & Tullock, G. (1962). *The Calculus of Consent*. Ann Arbor: The University of Michigan.
- Button, K. (1993). *Transport Economics* (2nd ed.). Cheltenham: Edward Elgar.
- Cameron, A. C., & Trivedi, P. K. (2005). *Microeconometrics: Methods and Applications*. New York: Cambridge University Press.
- Capello, R. (2014). Classical Contributions: Von Thünen, Weber, Christaller, Lösch. In M. M. Fischer & P. Nijkamp (Eds.), *Handbook of Regional Science*. Springer Verlag.
- Carson, R. T., Flores, N. E., & Mitchell, R. C. (2001). The Theory and Measurement of Passive-Use Value. In I. Bateman & K. G. Willis (Eds.), *Valuing Environmental Preferences: Theory and Practice of the Contingent Valuation Method in the US, EU, and Developing Countries*. New York: Oxford University Press.
- Chatman, D. G., & Noland, R. B. (2011). Do Public Transport Improvements Increase Agglomeration Economies? A Review of Literature and an Agenda for Research. *Transport Reviews*, 31(6), 725–742. <https://doi.org/10.1080/01441647.2011.587908>
- Ciccone, A., & Hall, R. E. (1996). Productivity and the Density of Economic Activity. *American Economic Review*, 86(1), 54–70.
- Combes, B. P., Duranton, G., Gobillon, L., Puga, D., & Roux, S. (2012). The Productivity Advantages of Large Cities: Distinguishing Agglomeration From Firm Selection. *Econometrica*, 80(6), 2543–2594. <https://doi.org/10.3982/ecta8442>
- Combes, P. P., & Gobillon, L. (2015). The Empirics of Agglomeration Economies. *Handbook of Regional and Urban Economics*, 5, 247–348. <https://doi.org/10.1016/B978-0-444-59517-1.00005-2>
- Dalvi, M. Q., & Martin, K. M. (1976). The Measurement of Accessibility: Some Preliminary Results. *Transportation*, 5, 17–42.
- Damart, S., & Roy, B. (2009). The uses of cost-benefit analysis in public transportation decision-making in France. *Transport Policy*, 16(4), 200–212. <https://doi.org/10.1016/j.tranpol.2009.06.002>

- De Bruijn, H., & Leijten, M. (2008). Mega-projects and contested information. In Hugo Priemus, B. Flyvbjerg, & B. van Wee (Eds.), *Decision-Making on Mega-Projects*. Heidelberg: Edward Elgar.
- De Bruijn, H., & Veeneman, W. (2009). Decision-making for light rail. *Transportation Research Part A: Policy and Practice*, 43, 349–359.
<https://doi.org/10.1016/j.tra.2008.11.003>
- de Jong, G., Daly, A., Pieters, M., & van der Hoorn, T. (2007). The logsum as an evaluation measure: Review of the literature and new results. *Transportation Research Part A: Policy and Practice*, 41(9 SPEC. ISS.), 874–889.
<https://doi.org/10.1016/j.tra.2006.10.002>
- Debrezion, G., Pels, E., & Rietveld, P. (2007). The impact of railway stations on residential and commercial property value: A meta-analysis. *Journal of Real Estate Finance and Economics*, 35(2), 161–180. <https://doi.org/10.1007/s11146-007-9032-z>
- Department for Transport. (2011). Creating Growth, Cutting Carbon: Making Sustainable Local Transport Happen. In *White Paper*.
<http://assets.dft.gov.uk/publications/making-sustainable-local-transport-happen/making-sustainable-local-transport-happen-whitepaper.pdf>
- Diao, M., Leonard, D., & Sing, T. F. (2017). Spatial-difference-in-differences models for impact of new mass rapid transit line on private housing values. *Regional Science and Urban Economics*, 67(September), 64–77.
<https://doi.org/10.1016/j.regsciurbeco.2017.08.006>
- Duranton, G., & Puga, D. (2004). Micro-foundations of urban agglomeration economies. In J. V. Henderson & J.-F. Thisse (Eds.), *Handbook of Regional and Urban Economics* (pp. 2063–2117). Elsevier. [https://doi.org/10.1016/S0169-7218\(04\)07048-0](https://doi.org/10.1016/S0169-7218(04)07048-0)
- Eliasson, J. (2016). Is congestion pricing fair? Consumer and citizen perspectives on equity effects. *Transport Policy*, 52, 1–15.
<https://doi.org/10.1016/j.tranpol.2016.06.009>
- Eliasson, J., Börjesson, M., Odeck, J., & Welde, M. (2015). Does Benefit–Cost Efficiency Influence Transport Investment Decisions? *Journal of Transport Economics and Policy*, 49(3), 377–396.
<http://www.ingentaconnect.com/content/lse/jtep/2015/00000049/00000003/art00002>
- Eliasson, J., & Fosgerau, M. (2013). Cost overruns and demand shortfalls – Deception or selection? *Transportation Research Part B: Methodological*, 57, 105–113.
<https://doi.org/10.1016/j.trb.2013.09.005>
- Eliasson, J., Kopsch, F., Mandell, S., & Wilhelmsson, M. (2020). Transport Mode and the Value of Accessibility – A Potential Input for Sustainable Investment Analysis. *Sustainability*, 12(5), 2143. <https://doi.org/10.3390/su12052143>
- Eliasson, J., & Lundberg, M. (2012). Do Cost-Benefit Analyses Influence Transport Investment Decisions? Experiences from the Swedish Transport Investment Plan 2010-21. *Transport Reviews*, 32(1), 29–48.
<https://doi.org/10.1080/01441647.2011.582541>

- Esteves, A. M., Franks, D., & Vanclay, F. (2012). Social impact assessment: The state of the art. *Impact Assessment and Project Appraisal*, 30(1), 34–42. <https://doi.org/10.1080/14615517.2012.660356>
- Ferguson, A. (1782). *An Essay on the History of Civil Society* (5th ed.). T. Cadell. <https://oll.libertyfund.org/titles/1428>
- Fischer, M. M., & Nijkamp, P. (2014). *Handbook of Regional Science*. Springer Verlag. <https://doi.org/10.1007/978-3-642-23430-9>
- Flyvbjerg, B. (2006). Five Misunderstandings About Case-Study Research. *Qualitative Inquiry*, 12(2), 219–245. <https://doi.org/10.1177/1077800405284363>
- Flyvbjerg, Bent. (2009). Survival of the unfittest: Why the worst infrastructure gets built—and what we can do about it. *Oxford Review of Economic Policy*, 25(3), 344–367. <https://doi.org/10.1093/oxrep/grp024>
- Flyvbjerg, Bent. (2016). The Fallacy of Beneficial Ignorance: A Test of Hirschman’s Hiding Hand. *World Development*, 84, 176–189. <https://doi.org/10.1016/j.worlddev.2016.03.012>
- Flyvbjerg, Bent, Ansar, A., Budzier, A., Buhl, S., Cantarelli, C., Garbuio, M., Glenting, C., Holm, M. S., Lovallo, D., Lunn, D., Molin, E., Rønne, A., Stewart, A., & van Wee, B. (2018). Five things you should know about cost overrun. *Transportation Research Part A: Policy and Practice*, 118(July), 174–190. <https://doi.org/10.1016/j.tra.2018.07.013>
- Friedman, M. (1953). *Essays in Positive Economics*. Chicago: University of Chicago Press.
- Fujita, M., Krugman, P. R., & Venables, A. (1999). *The spatial economy: cities, regions and international trade*. MIT Press. <http://ludwig.lub.lu.se/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=cab01310a&AN=lovisa.001191236&site=eds-live&scope=site>
- Geurs, K. T., Boon, W., & van Wee, B. (2009). Social Impacts of Transport: Literature Review and the State of the Practice of Transport Appraisal in the Netherlands and the United Kingdom. *Transport Reviews*, 29(1), 69–90. <https://doi.org/10.1080/01441640802130490>
- Geurs, K., & van Wee, B. (2004). Accessibility evaluation of land-use and transport strategies: Review and research directions. *Journal of Transport Geography*, 12(2), 127–140. <https://doi.org/10.1016/j.jtrangeo.2003.10.005>
- Geurs, K., & van Wee, B. (2013). Accessibility: perspectives, measures and applications. In B. van Wee, J. A. Annema, & D. Banister (Eds.), *The transport system and transport policy: an introduction*. Cheltenham: Edward Elgar.
- Glaeser, E. L. (2011). *Triumph of the city*. US: The Penguin Press.
- Graham, D. J., & van Dender, K. (2011). Estimating the agglomeration benefits of transport investments: Some tests for stability. *Transportation*, 38(3), 409–426. <https://doi.org/10.1007/s11116-010-9310-0>
- Greene, W. H. (2012). *Econometric analysis* (7th ed.). Harlow: Pearson.
- Guerra, E., Cervero, R., & Tischler, D. (2012). Half-mile circle. *Transportation Research Record*, 2276, 101–109. <https://doi.org/10.3141/2276-12>

- Gutiérrez-i-Puigarnau, E., & van Ommeren, J. N. (2015). Commuting and labour supply revisited. *Urban Studies*, 52(14), 2551–2563. <https://doi.org/10.1177/0042098014550452>
- Hahn, R. W., & Tetlock, P. C. (2008). Has Economic Analysis Improved Regulatory Decisions? *Journal of Economic Perspectives*, 22(1), 67–84.
- Handy, S. L., & Niemeier, D. A. (1997). Measuring accessibility: An exploration of issues and alternatives. *Environment and Planning A*, 29(7), 1175–1194. <https://doi.org/10.1068/a291175>
- Hansen, W. G. (1959). How Accessibility Shapes Land Use. *Journal of the American Planning Association*, 25(2), 73–76. <https://doi.org/10.1080/01944365908978307>
- Hayek, F. A. (1978). *New Studies in Philosophy, Politics, Economics and the History of Ideas*. London: Routledge.
- Henderson, J. V. (2007). Understanding knowledge spillovers. *Regional Science and Urban Economics*, 37, 497–508. <https://doi.org/10.1016/j.regsciurbeco.2006.11.010>
- Hickman, R., & Dean, M. (2018). Incomplete cost–incomplete benefit analysis in transport appraisal. *Transport Reviews*, 38(6), 689–709. <https://doi.org/10.1080/01441647.2017.1407377>
- Hicks, J. R. (1939). The Foundations of Welfare Economics. *The Economic Journal*, 49(196), 696–712.
- Ho, D. E., Imai, K., King, G., & Stuart, E. A. (2011). MatchIt: Nonparametric preprocessing for parametric causal inference. *Journal of Statistical Software*, 42(8), 1–28. <https://doi.org/10.18637/jss.v042.i08>
- Holland, P. W. (1986). Statistics and causal inference. *Journal of the American Statistical Association*, 81(396), 945–960. <https://doi.org/10.1080/01621459.1986.10478354>
- Holmgren, J., & Merkel, A. (2017). Much ado about nothing? – A meta-analysis of the relationship between infrastructure and economic growth. *Research in Transportation Economics*, 63, 13–26. <https://doi.org/10.1016/j.retrec.2017.05.001>
- Hoogendoorn, S., Van Gemeren, J., Verstraten, P., & Folmer, K. (2019). House prices and accessibility: Evidence from a quasi-experiment in transport infrastructure. *Journal of Economic Geography*, 19(1), 57–87. <https://doi.org/10.1093/jeg/lbx027>
- Hrelja, R., Pettersson, F., & Westerdahl, S. (2016). The qualities needed for a successful collaboration: A contribution to the conceptual understanding of collaboration for efficient public transport. *Sustainability*, 8(6). <https://doi.org/10.3390/su8060542>
- Huang, J., Levinson, D., Wang, J., Zhou, J., & Wang, Z. J. (2018). Tracking job and housing dynamics with smartcard data. *Proceedings of the National Academy of Sciences of the United States of America*, 115(50), 12710–12715. <https://doi.org/10.1073/pnas.1815928115>
- Hubin, D. C. (1994). The moral justification of benefit/cost analysis. *Economics and Philosophy*, 10(2), 169–194. <https://doi.org/10.1017/S0266267100004727>
- Hüging, H., Glensor, K., & Lah, O. (2014). Need for a Holistic Assessment of Urban Mobility Measures - Review of Existing Methods and Design of a Simplified Approach. *Transportation Research Procedia*, 4, 3–13. <https://doi.org/10.1016/j.trpro.2014.11.001>

- Hultén, J. (2012). *Ny väg till nya vägar och järnvägar*. Lund University.
- Hultkrantz, L., & Nilsson, J.-E. (2004). *Samhällsekonomisk analys: En introduktion till mikroekonomin* (2nd ed.). Stockholm: SNS Förlag.
- Imbens, G. W., & Wooldridge, J. M. (2009). Recent developments in the econometrics of program evaluation. *Journal of Economic Literature*, 47(1), 5–86.
<https://doi.org/10.1257/jel.47.1.5>
- Jackson, P. M. (2011). Governance by numbers: What have we learned over the past 30 years? *Public Money and Management*, 31(1), 13–26.
<https://doi.org/10.1080/09540962.2011.545542>
- Jacobs, J. (1969). *The Economy of Cities*. New York: Random House.
- Johansson, B., Klaesson, J., & Olsson, M. (2003). Commuters' non-linear response to time distances. *Journal of Geographical Systems*, 5, 315–329.
<https://doi.org/10.1007/s10109-003-0111-2>
- Johnson, D., Ercolani, M., & Mackie, P. (2017). Econometric analysis of the link between public transport accessibility and employment. *Transport Policy*, 60, 1–9.
<https://doi.org/10.1016/j.tranpol.2017.08.001>
- Jones, P., & Lucas, K. (2012). The social consequences of transport decision-making: Clarifying concepts, synthesising knowledge and assessing implications. *Journal of Transport Geography*, 21, 4–16. <https://doi.org/10.1016/j.jtrangeo.2012.01.012>
- Kaldor, N. (1939). Welfare Propositions of Economics and Interpersonal Comparisons of Utility. *The Economic Journal*, 49(195), 549–552.
- Kay, J., & King, M. (2020). *Radical Uncertainty: Decision-making for an unknowable future*. London: The Bridge Street Press.
- Kornhauser, L. A. (2000). On Justifying Cost-Benefit Analysis. *The Journal of Legal Studies*, 29(S2), 1037–1057.
- Kumarage, A. S., & Weerawardana, J. (2013). System cost-based multi-criteria analysis for urban transport solutions. *International Journal of Urban Sciences*, 17(2), 212–225. <https://doi.org/10.1080/12265934.2013.776285>
- Laird, J., Geurs, K., & Nash, C. (2009). Option and non-use values and rail project appraisal. *Transport Policy*, 16(4), 173–182.
<https://doi.org/10.1016/j.tranpol.2009.05.002>
- Laird, J. J., & Mackie, P. J. (2014). Wider economic benefits of transport schemes in remote rural areas. *Research in Transportation Economics*, 47, 92–102.
<https://doi.org/10.1016/j.retrec.2014.09.022>
- Laird, J. J., & Venables, A. J. (2017). Transport investment and economic performance: A framework for project appraisal. *Transport Policy*, 56(February), 1–11.
<https://doi.org/10.1016/j.tranpol.2017.02.006>
- Lakshmanan, T. R. (2011). The broader economic consequences of transport infrastructure investments. *Journal of Transport Geography*, 19, 1–12.
<https://doi.org/10.1016/j.jtrangeo.2010.01.001>
- Law, J., & Urry, J. (2004). Enacting the social. *Economy and Society*, 33(3), 390–410.
<https://doi.org/10.1080/0308514042000225716>

- Lee, D. B. J. (2000). Methods for evaluation of transportation projects in the USA. *Transport Policy*, 7, 41–50.
- Levinson, D., Marion, B., Owen, A., & Cui, M. (2017). The City is flatter: Changing patterns of job and labor access. *Cities*, 60, 124–138. <https://doi.org/10.1016/j.cities.2016.08.002>
- Lindblom, C. E. (1959). The Science of “Muddling Through.” *Administrative Review*, 19(2), 79–88. <https://doi.org/10.4324/9780429498411>
- Lindsay, C. M. (1969). Option Demand and Consumer’s Surplus. *The Quarterly Journal of Economics*, 83(2), 344–346.
- Litman, T. (2017). *Evaluating Public Transit Benefits and Costs: Best Practices Guidebook*. <http://www.vtpti.org/tranben.pdf>
- Lucas, K. (2012). Transport and social exclusion: Where are we now? *Transport Policy*, 20, 105–113. <https://doi.org/10.1016/j.tranpol.2012.01.013>
- Lucas, K. (2019). A new evolution for transport-related social exclusion research? *Journal of Transport Geography*, 81, 1–4. <https://doi.org/10.1016/j.jtrangeo.2019.102529>
- Lucas, R. E. (1988). On the mechanics of economic development. *Journal of Monetary Economics*, 22(1), 3–42. [https://doi.org/10.1016/0304-3932\(88\)90168-7](https://doi.org/10.1016/0304-3932(88)90168-7)
- Macharis, C, Witte, a De, & Ampe, J. (2009). The multi-actor, multi-criteria analysis methodology (MAMCA) for the evaluation of transport projects: Theory and practice. ... of *Advanced Transportation*, 43(2), 183–202. <https://doi.org/10.1002/atr.5670430206>
- Macharis, Cathy, & Bernardini, A. (2015). Reviewing the use of multi-criteria decision analysis for the evaluation of transport projects: Time for a multi-actor approach. *Transport Policy*, 37, 177–186. <https://doi.org/10.1016/j.tranpol.2014.11.002>
- Macharis, Cathy, Turcksin, L., & Lebeau, K. (2012). Multi actor multi criteria analysis (MAMCA) as a tool to support sustainable decisions: State of use. *Decision Support Systems*, 54(1), 610–620. <https://doi.org/10.1016/j.dss.2012.08.008>
- Mackie, P. (2010). *Cost-benefit analysis in transport: a UK perspective*. *International Transport Forum. Joint Transport Research Centre ROUND TABLE 21-22 October 2010, Mexico. October*, 1–27.
- Mackie, Peter, Worsley, T., & Eliasson, J. (2014). Transport appraisal revisited. *Research in Transportation Economics*, 47, 3–18. <https://doi.org/10.1016/j.retrec.2014.09.013>
- Marshall, A. (1920). *Principles of Economics*. London: Macmillan and Co. Ltd.
- McFadden, D. L. (1973). Conditional Logit Analysis of Qualitative Choice Behavior. In P. Zarembka (Ed.), *Frontiers in Econometrics*. New York: Wiley.
- Melo, P. C., Graham, D. J., & Brage-Ardao, R. (2013). The productivity of transport infrastructure investment: A meta-analysis of empirical evidence. *Regional Science and Urban Economics*, 43(5), 695–706. <https://doi.org/10.1016/j.regsciurbeco.2013.05.002>
- Melo, P. C., Graham, D. J., Levinson, D., & Aarabi, S. (2017). Agglomeration, accessibility and productivity: Evidence for large metropolitan areas in the US. *Urban Studies*, 54(1), 179–195. <https://doi.org/10.1177/0042098015624850>

- Miller, E. J. (2018). Accessibility: measurement and application in transportation planning. *Transport Reviews*, 38(5), 551–555. <https://doi.org/10.1080/01441647.2018.1492778>
- Miser, H. J. (1995). *Handbook of Systems Analysis: Cases*. Chichester: John Wiley and Sons.
- Mohammad, S. I., Graham, D. J., Melo, P. C., & Anderson, R. J. (2013). A meta-analysis of the impact of rail projects on land and property values. *Transportation Research Part A: Policy and Practice*, 50, 158–170. <https://doi.org/10.1016/j.tra.2013.01.013>
- Mouter, N., Annema, J. A., & van Wee, B. (2013). Ranking the substantive problems in the Dutch Cost–Benefit Analysis practice. *Transportation Research Part A: Policy and Practice*, 49, 241–255. <https://doi.org/10.1016/j.tra.2013.01.020>
- Næss, P. (2006). Cost-Benefit Analyses of Transportation Investments. *Journal of Critical Realism*, 5(1), 32–60. <https://doi.org/10.1558/jocr.v5i1.32>
- Nellthorp, J., & Mackie, P. J. (2000). The UK roads review - a hedonic model of decision making. *Transport Policy*, 7(2), 127–138. [https://doi.org/10.1016/S0967-070X\(00\)00002-0](https://doi.org/10.1016/S0967-070X(00)00002-0)
- Nilsen, Ø. L., Díez Gutiérrez, M., Andersen, S. N., & Tørset, T. (2017). Do fixed links affect the local labour markets and industries? A case study of three fixed link projects in Norway. *Case Studies on Transport Policy*, 5(2), 233–244. <https://doi.org/10.1016/j.cstp.2017.01.006>
- Nilsson, J.-E. (1991). Investment decisions in a public bureaucracy. *Journal of Transport Economics and Policy*, 25(2), 163–175.
- Norman, T., Börjesson, M., & Anderstig, C. (2017). Labour Market Accessibility and Unemployment. *Journal of Transport Economics and Policy*, 51(1), 47–73(27). <http://www.ingentaconnect.com/contentone/lse/jtep/2017/00000051/00000001/art00005>
- Nussbaum, M. C. (2000). The Costs of Tragedy: Some Moral Limits of Cost-Benefit Analysis. *The Journal of Legal Studies*, 29(S2), 1005–1036.
- Odeck, J. (1996). Ranking of regional road investment in Norway: Does socioeconomic analysis matter? *Transportation*, 23(2), 123–140. <https://doi.org/10.1007/BF00170032>
- Odgaard, T., Kelly, C. E., & Laird, J. (2006). *Current Practice in Project Appraisal in Europe*. http://eprints.whiterose.ac.uk/1969/1/priestleym4_A_Tale_of_Two_Cities_
- OECD. (2018). *Cost benefit analysis and the environment: Further developments and policy use*. OECD Publishing. <https://doi.org/https://doi.org/10.1787/9789264085169-en>
- Ostrom, E. (2005). *Understanding Institutional Diversity*. Princeton University Press. <https://doi.org/10.1007/s11127-007-9157-x>
- Pareto, V. (1906). *Manuale di economia politica*. Milano: Societa` Editrice Libreria.
- Parry, I. W. H., & Small, K. A. (2009). Should Urban Transit Subsidies Be Reduced? *The American Economic Review*, 99(3), 700–724. <http://www.jstor.org/stable/25592479>
- Percoco, M. (2014). The impact of road pricing on housing prices: Preliminary evidence from Milan. *Transportation Research Part A: Policy and Practice*, 67(January 2008), 188–194. <https://doi.org/10.1016/j.tra.2014.07.006>

- Pereira, R. H. M., Schwanen, T., & Banister, D. (2017). Distributive justice and equity in transportation. *Transport Reviews*, 37(2), 170–191. <https://doi.org/10.1080/01441647.2016.1257660>
- Pettersson, F., & Hrelja, R. (2020). How to create functioning collaboration in theory and in practice—practical experiences of collaboration when planning public transport systems. *International Journal of Sustainable Transportation*, 14(1), 1–13. <https://doi.org/10.1080/15568318.2018.1517842>
- Pilegaard, N., & Fosgerau, M. (2008). Cost Benefit Analysis of a Transport Improvement in the Case of Search Unemployment. *Journal of Transport Economics and Policy*, 42(1), 23–42.
- Preston, J., & Rajé, F. (2007). Accessibility, mobility and transport-related social exclusion. *Journal of Transport Geography*, 15(3), 151–160. <https://doi.org/10.1016/j.jtrangeo.2006.05.002>
- Priemus, H. (2008). How to improve the early stages of decision-making on mega-projects. In H. Priemus, B. Flyvbjerg, & B. van Wee (Eds.), *Decision-Making on Mega-Projects*. Cheltenham: Edward Elgar.
- Proost, S., & Thisse, J.-F. (2019). What Can Be Learned from Spatial Economics? *Journal of Economic Literature*, 57(3), 575–643. <https://doi.org/10.1257/jel.20181414>
- Prop. 2008/09:93. *Mål för framtidens resor och transporter*. Stockholm: Näringsdepartementet.
- Putnam, H. (2002). *The Collapse of the Fact/Value Dichotomy and Other Essays*. Cambridge, MA: Harvard University Press.
- Reggiani, A., Bucci, P., Russo, G., Haas, A., & Nijkamp, P. (2011). Regional labour markets and job accessibility in City Network systems in Germany. *Journal of Transport Geography*, 19(4), 528–536. <https://doi.org/10.1016/j.jtrangeo.2010.05.008>
- Richards, D. (1996). Elite Interviewing: Approaches and Pitfalls. *Politics*, 16(3), 199–204. <https://doi.org/10.1111/j.1467-9256.1996.tb00039.x>
- Richardson, H. S. (2000). The Stupidity of the Cost-Benefit Standard. *Journal of Legal Studies*, 29(S2), 971–1003.
- Rietveld, P. (1994). Spatial economic impacts of transport infrastructure supply. *Transportation Research Part A*, 28A(4), 329–341. [https://doi.org/10.1016/0965-8564\(94\)90007-8](https://doi.org/10.1016/0965-8564(94)90007-8)
- Riksrevisionen. (2019). *Att planera för framtiden – statens arbete med scenarier: Vol. 2019:4*.
- Rosen, S. (1974). Hedonic Prices and Implicit Markets: Product Differentiation in Pure Competition. *Journal of Political Economy*, 82(1), 34–55.
- Rubin, D. B. (1974). Estimating causal effects of treatment in randomized and nonrandomized studies. *Journal of Educational Psychology*, 66(5), 688–701.
- RUFS 2001. (2001). Regional utvecklingsplan 2001 för Stockholmsregionen. In *Development* (Issue May). Stockholms: Katarina Tryck.
- RUFS 2010. (2010). *Regional utvecklingsplan för Stockholmsregionen*. Stockholms läns landsting. Rapport 2010:5.

- RUFS 2050. (2018). *Regional utvecklingsplan för Stockholmsregionen 2050*.
- Ryan, J., Wretstrand, A., & Schmidt, S. M. (2019). Disparities in mobility among older people: Findings from a capability-based travel survey. *Transport Policy*, 79, 177–192. <https://doi.org/10.1016/j.tranpol.2019.04.016>
- Sandberg, J. (2005). How do we justify knowledge produced within interpretive approaches? *Organizational Research Methods*, 8(1), 41–68. <https://doi.org/10.1177/1094428104272000>
- Scott, R. P., Scott, T. A., & Zerbe, R. (2016). Bureaucratic Benefit-Cost Analysis and Policy Controversy. *Journal of Benefit-Cost Analysis*, 7(2), 350–371. <https://doi.org/10.1017/bca.2016.3>
- Sen, A. (2000). The discipline of cost-benefit analysis. *Journal of Legal Studies*, 29(2), 931–952. <https://doi.org/10.1086/468100>
- Sen, A. (2009). *The Idea of Justice*. London: Penguin Books.
- Lag om kollektivtrafik (SFS (2010:1065)). *Swedish public transport act*. Stockholm: Infrastrukturdepartementet.
- Shackle, G. L. S. (1972). *Epistemics and Economics: A critique of economic doctrines*. Cambridge University Press.
- Simon, H. A. (1976). *Administrative Behavior: A Study of Decision-Making Processes in Administrative Organization* (3rd ed.). New York: Free Press.
- Simon, H. A. (1978). *Rational Decision-Making in Business Organizations*. Prize Lecture. Nobel Media AB 2019. <https://www.nobelprize.org/uploads/2018/06/simon-lecture.pdf>
- Smith, A. (1976). *An inquiry into the nature and causes of the wealth of nations*. US: Liberty Fund.
- Stanley, J., & Lucas, K. (2008). Social exclusion: What can public transport offer? *Research in Transportation Economics*, 22(1), 36–40. <https://doi.org/10.1016/j.retrec.2008.05.009>
- Stjernborg, V., & Mattisson, O. (2016). The Role of public Transport in Society - A Case Study of General policy Documents in Sweden. *Sustainability*, 8, 1–16. <https://doi.org/10.3390/su8111120>
- Talvitie, A. (2000). Evaluation of road projects and programs in developing countries. *Transport Policy*, 7, 61–72.
- te Brömmelstroet, M., Skou Nicolaisen, M., Büttner, B., & Ferreira, A. (2017). Experiences with transportation models: An international survey of planning practices. *Transport Policy*, 58(May 2016), 10–18. <https://doi.org/10.1016/j.tranpol.2017.04.007>
- Thoresson, K. (2011). *Att beräkna det goda samhället: Samhällsekonomiska analyser och gränslandet expertis-politik inom transportområdet*. Linköpings Universitet.
- Trafikanalys. (2018). *Regional linjetrafik*. Trafikanalys Statistik 2019:22.
- Trafikförvaltningen. (2015a). *Programstudie, Lokaliseringsutredning (Location investigation)*.
- Trafikförvaltningen. (2015b). *Programstudie, Miljökonsekvensbeskrivning (Environmental impact assessment)*.

- Trafikförvaltningen. (2015c). *Programstudie, Social konsekvensbeskrivning (Social impact assessment)*.
- Trafikförvaltningen. (2015d). *Trafikanalys av Spårväg syd – huvudscenario (Transport analysis of Spårväg syd – main scenario)* (Vol. 1).
- Transport for London. (2020). *How we are funded*. <https://tfl.gov.uk/corporate/about-tfl/how-we-work/how-we-are-funded>
- Tsamboulas, D., Yiotis, G. S., & Panou, K. D. (1999). Use of Multicriteria Methods for Assessment of Transport Projects. *Journal of Transportation Engineering*, 125(5), 407–414.
- Tveter, E., Welde, M., & Odeck, J. (2017). Do Fixed Links Affect Settlement Patterns: A Synthetic Control Approach. *Research in Transportation Economics*, 63, 59–72. <https://doi.org/10.1016/j.retrec.2017.07.002>
- van Wee, B. (2012). How suitable is CBA for the ex-ante evaluation of transport projects and policies? A discussion from the perspective of ethics. *Transport Policy*, 19(1), 1–7. <https://doi.org/10.1016/j.tranpol.2011.07.001>
- van Wee, B. (2016). Accessible accessibility research challenges. *Journal of Transport Geography*, 51, 9–16. <https://doi.org/10.1016/j.jtrangeo.2015.10.018>
- van Wee, B., & Roeser, S. (2013). Ethical Theories and the Cost-Benefit Analysis-Based Ex Ante Evaluation of Transport Policies and Plans. *Transport Reviews*, 33(6), 743–760. <https://doi.org/10.1080/01441647.2013.854281>
- van Wee, B., van Cranenburgh, S., & Maat, K. (2019). Substitutability as a spatial concept to evaluate travel alternatives. *Journal of Transport Geography*, 79. <https://doi.org/10.1016/j.jtrangeo.2019.102469>
- Venter, C., & Leong, W. Y. (2018). Workshop 6 report: Wider impacts of public transport and successful implementation of desirable and beneficial projects. *Research in Transportation Economics*, 69, 489–493. <https://doi.org/10.1016/j.retrec.2018.08.006>
- Vetenskapsrådet. (2014). *Evaluation of the MONA system (Microdata Online Access)*.
- Vigren, A., & Ljungberg, A. (2018). Public Transport Authorities' use of Cost-Benefit Analysis in practice. *Research in Transportation Economics*, 69, 560–567. <https://doi.org/10.1016/j.retrec.2018.06.001>
- Wangsness, P. B., Rødseth, K. L., & Hansen, W. (2017). A review of guidelines for including wider economic impacts in transport appraisal. *Transport Reviews*, 37(1), 94–115. <https://doi.org/10.1080/01441647.2016.1217283>
- Weisbrod, B. A. (1964). Collective-Consumption Services of Individual-Consumption Goods. *The Quarterly Journal of Economics*, 78(3), 471–477. <https://doi.org/10.1007/s13398-014-0173-7.2>
- Weisbrod, G. E., Lerman, S. R., & Ben-Akiva, M. (1980). Tradeoffs in residential location decisions: transportation versus other factors. *Transport Policy and Decision Making*, 1(1), 13–26. <http://www.edrgrout.com/images/stories/Transportation/tradeoffs-tpd.pdf>
- Williams, A. (1974). The Cost-Benefit Approach. *British Medical Bulletin*, 30(3), 252–256.

- Wing, C., Simon, K., & Bello-Gomez, R. A. (2018). Designing Difference in Difference Studies: Best Practices for Public Health Policy Research. *Annual Review of Public Health, 39*(1), 453–469. <https://doi.org/10.1146/annurev-publhealth-040617-013507>
- Wollstonecraft, M. (1987). *Letters written during a short residence in Sweden, Norway, and Denmark*. London: Penguin Books.
- Åslund, O., Blind, I., & Dahlberg, M. (2017). All aboard? Commuter train access and labor market outcomes. *Regional Science and Urban Economics, 67*, 90–107. <https://doi.org/10.1016/j.regsciurbeco.2017.08.007>

Appendix

Interview guide paper 1

The interview begins with an introduction of the research project and an explanation why we do interviews. Interview questions:

Please describe your role in the organization

What is your role in the planning process?

Can you tell me about a project that you participated in?

What would you say is the role of the public transport system in your region?

Can you elaborate on the goals and objectives of the regional public transport?

Do you have an example of a project that was important in terms of a long-term goal?

What kind of analyses are made prior to public transport measures?

Are you doing a CBA?

If yes: how do you interpret the result?

If no: why not?

Are you doing other analyses?

Impact assessments?

Analyses of objective fulfillment?

How are the analyses compiled?

How well do the available tools match political visions?

Do the tools need to be changed or adjusted?

Is there something you want to add?

Interview guide paper 2

The interviews consisted of two parts. The initial *general discussion* was intended to create a picture of the general arguments for Spårväg Syd.

What do you think about the benefits or contribution that public transport in Spårväg Syd provides?

What are your reflections about the reasons why Spårväg Syd arose?

How did you work when the goals for an investment such as Spårväg Syd were set up?

Collaboration between different stakeholders?

Did the county and local authorities have the same objectives?

What role do you think investment in Spårväg Syd has for opportunities for transport?

Are there network effects such as “the value of the system is greater than the sum of all the individual lines”?

From the passengers’ perspective

From the perspective of the public transport provider

Then, a brief overview was presented of the methods that are used or could be used as decision making data for investments or measures in the public transport system.

The presentation differentiated between evaluation tools, consequence analyses and indicators. Socioeconomic calculation (CBA), multi-criteria analysis (MCA) and combined effect assessment (SEB) are examples of evaluation tools; environmental consequence description (MKB) and social consequence analysis are examples of consequence analyses; travel time ratio and customer satisfaction are examples of indicators.

With the presentation as a starting point, reflections on the methods’ relevance were discussed in the context of calculations that were performed before investment in Spårväg Syd.

Have you any reflections about the measurements and methods that we have just presented?

Can you describe how you worked on defining what was to be measured?

What was included in your analyses?

How do you intend to measure the effects of the investment afterwards?

Are there any differences between the needs of the local and county authorities?

Do the available tools and analysis methods answer the question of whether Spårväg Syd is a good investment?

What are the most important benefits that you will be able to measure?

What stakeholders do you think have the greatest significance for producing this?

Who do you think is the real “receiver” of methods and measurements?

List of included papers

Paper 1

Evaluation of public transport: regional policies and planning practices in Sweden

E. Johansson, L. W. Hiselius, T. Koglin and A. Wretstrand

Published in *Urban, Planning and Transport Research* 5(1), 59-77 (2017)

Paper 2

Appraisal of a regional transport project: A document and interview analysis of a light rail case in Sweden

E. Johansson, A. Anund and T. Koglin

Published in *Case Studies on Transport Policy* 7, 196-204 (2019)

Paper 3

Accessibility and uncertainty: An empirical analysis of option value in transport

A. Bondemark, E. Johansson, and F. Kopsch

Accepted with revisions in *Journal of Transport and Land Use*

Paper 4

The impact of commuter train stations on people and places: a difference-in-differences analysis

E. Johansson

Submitted to *Annals of Regional Science*

Paper 5

Railway network design and regional labour markets in Sweden

E. Johansson, R. Camporeale and C.-W. Palmqvist

In press in *Research in Transportation Economics*

Declaration of contribution

Paper 4 is a work made completely by Johansson. In Paper 1, and 2 Johansson was the main author responsible for research question formulation, literature overviews. In Paper 1 Johansson did the interviews, transcribed and, analysed them. In Paper 2, Johansson participated in the interviews and analysis, did the document and scientific literature reading, and was the main author of the paper. In Paper 3 Johansson was the main author, and part of the work of formulating research question and overviewing literature. In Paper 5, Johansson conducted the statistical analyses as well as the preparing the data and wrote minor parts of the text.

The knowledge problem of public transport policy



The overall aim of the thesis is to investigate the knowledge problem in regional public transport planning. The knowledge problem is twofold. How do transport policy arrive at the desirable actions they take and how do they assess the alternatives, and what can we say about the contributions of already implemented transport schemes. The thesis increases the evidence of effects of transport on income and real estate prices. Moreover, the thesis concludes that regional public transport planning seems to be subject to different motivations and trade-offs depending on project and context, which complicates the seeking for a universal appraisal procedure.

